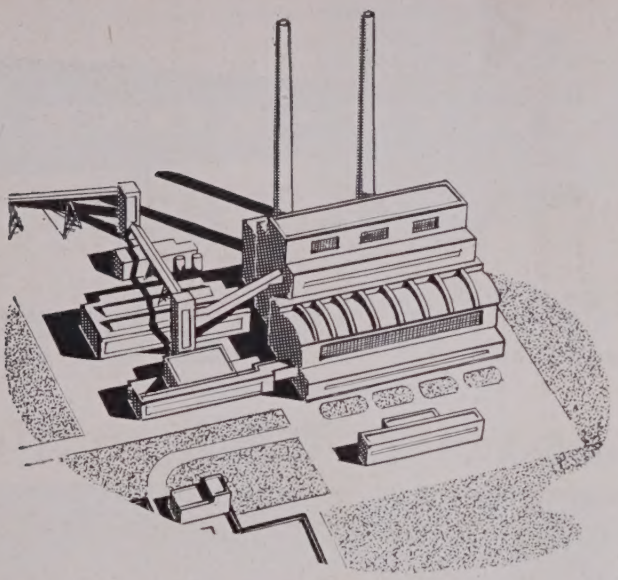
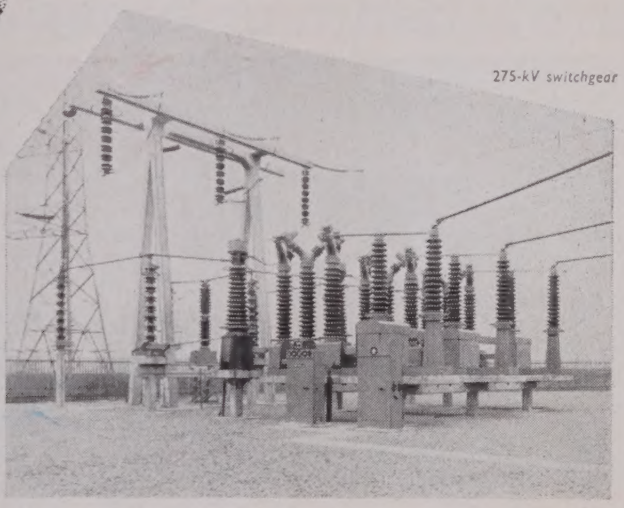
ELECTRICAL REVIEW

FRIDAY
3 MARCH 1961

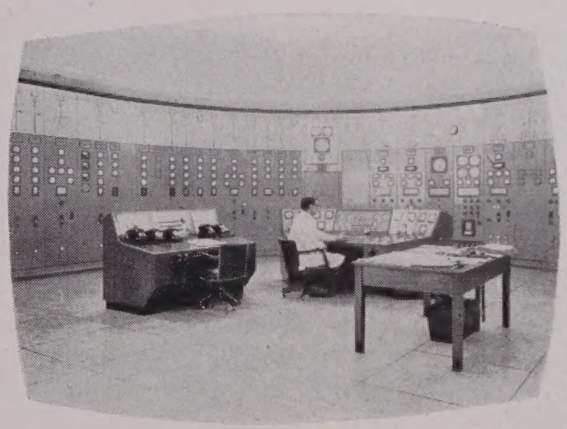
WEEKLY
PRICE 1s 6d



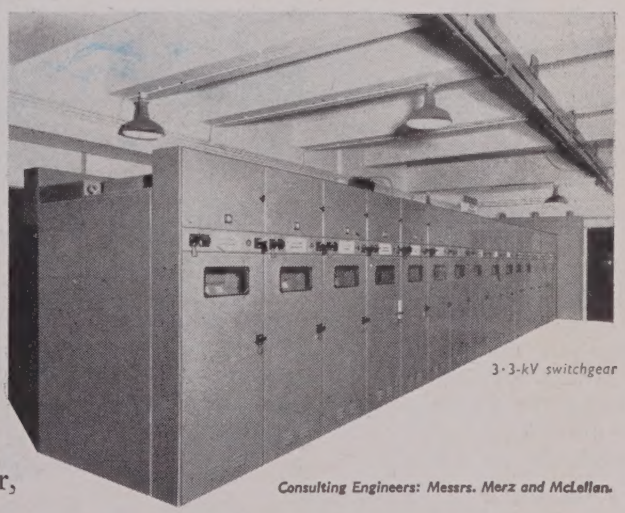
Blyth A
GENERATING STATION



275-kV switchgear



Main control-room



3·3-kV switchgear

Consulting Engineers: Messrs. Merz and McLellan.

[Photographs by courtesy of C.E.G.B., North Eastern Division.

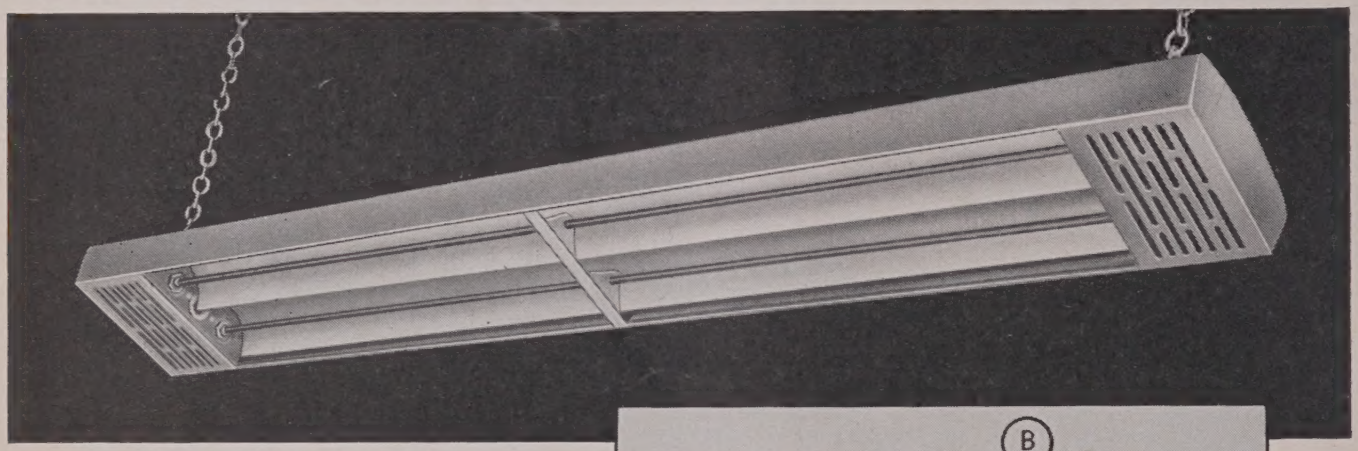
Reyrolle supplied the 275-kV air-blast switchgear, 66-kV small-oil-volume switchgear, 3·3-kV air-break auxilliaries switchgear, and 415-volt distribution gear together with associated control-equipment.

Reyrolle

A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND

NEW! TWIN-ZONE overhead radiant heaters

narrow beam or broad beam from one model



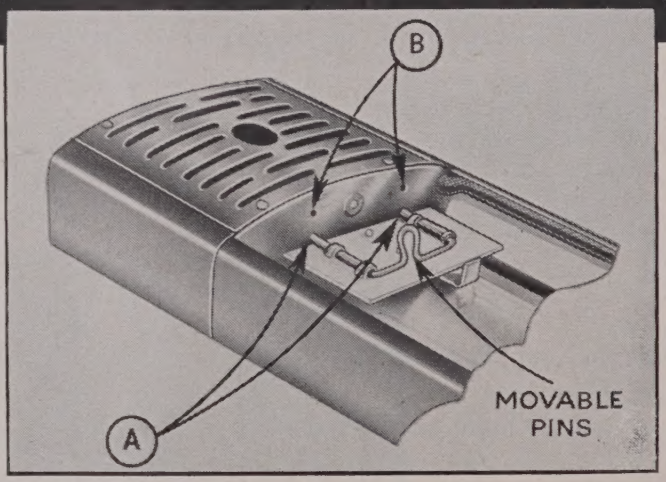
Of entirely new and unique design, these Twin-Zone overhead Radiant Heaters, in 1½ or 3 kW. loading, will give you more efficient and versatile heating than ever before. New high-density elements, completely safe in use, produce more heat per inch and the polished aluminium reflector radiates it with the maximum effect.

By a simple adjustment of the reflectors, Twin-Zone Radiant Heaters can be preset to give a concentrated or a widespread beam of warmth according to requirement.

Twin-Zone Radiant Heaters are ideal for use in commercial, industrial or public buildings and other premises where only intermittent heating is required or where poor thermal insulation makes overall air heating impracticable.

(Not available for domestic use).

- *Versatility*
- *Low Price*
- *High Efficiency*
- *Attractive Slim Design*
- *Long Life 'Safety' Element*



A *Narrow beam position providing concentrated warmth over isolated sections of large buildings such as loading bays, hangers, machine shops and garages.*

B *Broad beam position giving a widespread zone of heat and can be used for complete heating installations in churches, village halls, community centres and similar buildings whether used intermittently or continuously.*

1½kW – £8 . 5 . 0. (HO 6434) **3kW – £10 . 0 . 0. (HO 6435)**

G.E.C.

The G.E.C. specialises in industrial heating and manufactures every type of appliance. We shall be very pleased to give you free advice on any of your heating problems.

FOR SPACE HEATING

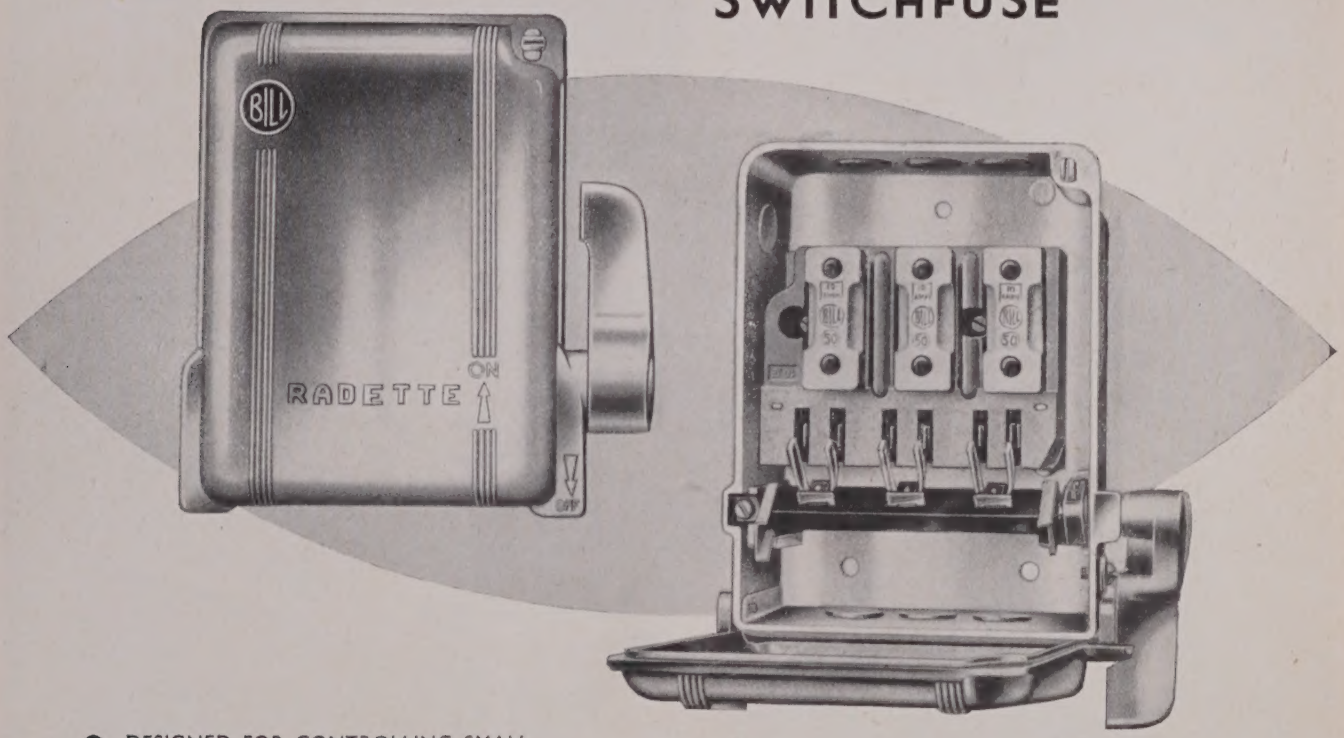
A NEW PLAN FOR YOUR CLIENTS — *Send for details of the new G.E.C. Extended Credit Plan which earns Profits while you pay.*

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

You cannot buy better gear

BILL RADETTE Q1438 MARK II

THE MODERN MOTOR CONTROL SWITCHFUSE



- DESIGNED FOR CONTROLLING SMALL MOTORS NOT EXCEEDING 5 H.P.
- 10 AMPERE 500 VOLTS, 3 PHASE, QUICK MAKE AND BREAK SWITCH WITH SUBSTANTIAL CONTACTS FOR HIGH CONTACT EFFICIENCY AND LONG LIFE
- BILL ARC DAMPING TYPE FUSES FITTED COMPLETE WITH FUSE WIRE BY QUICK ACTION CLAMPS
- AMPLE KNOCKOUTS AND GENEROUS WIRING SPACE PROVIDED. 3—$\frac{3}{4}$" KNOCKOUT HOLES TOP AND BOTTOM. 1—$\frac{3}{4}$" KNOCKOUT HOLE IN LEFT HAND SIDE FOR STARTER CONNECTION.
- 'THROUGH' WIRING ARRANGED UNDER THE SWITCH BASE
- NO DISMANTLING OF SWITCH MECHANISM IS NECESSARY
- SOLID FORTOL BRUSH BAR TO ELIMINATE EARTHING
- FINISHED IN BILL SILVERLOSE— A DURABLE STOVED ALUMINIUM ENAMEL

ELECTRICAL ENGINEERS (A.S.E.E.) EXHIBITION

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BIRMINGHAM·20

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STAND No. L8

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COULDN'T FIND ANY OTHER FLUORESCENT LAMPS WITH ALL THESE FIVE ADVANTAGES

You can search high and low but, wherever you look, you'll always find it's only Philips who offer fluorescent lamps with all five of these major advantages. So, for fluorescent that's far, far ahead, specify Philips!

1 De luxe lamps with double phosphor coating—Colour 32 the established choice for superb lighting of food, and the new Colour 34 for lighting clothes. Specify double-coated—they cost no more than single-coated de luxe.

2 Grain-size selected phosphors for maximum lumen output. Ultra modern machinery mills phosphor particles to the optimum size, rejects any that are not right. Hence the top luminous efficiency, maintained throughout the life of the lamp.

3 A special binder guards the electrode emissive coating and, together with high purity fill gases, ensures life that is getting longer and longer.

4 All standard lamps above have *both* silicone coating *and* earthing strip. 'Belt and braces' technique gives sure starting, means one stock type only for each and every fitting.

5 Fully closed anode ring (80W 5 ft.) reduces end-blackening and extend electrode life.

Once again

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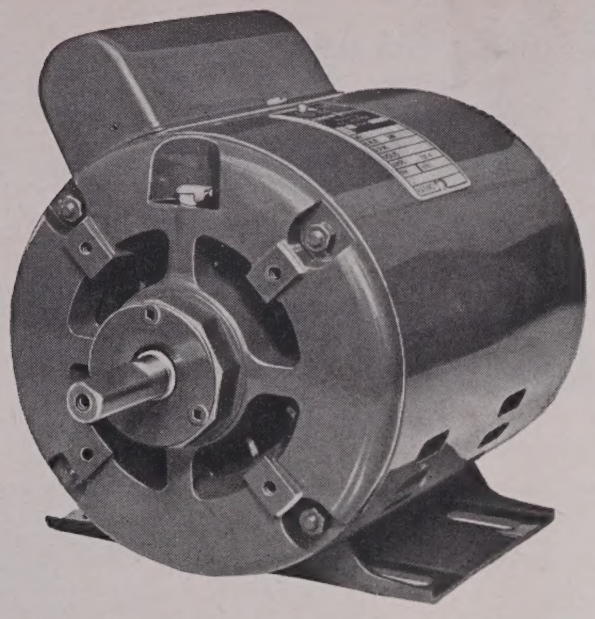
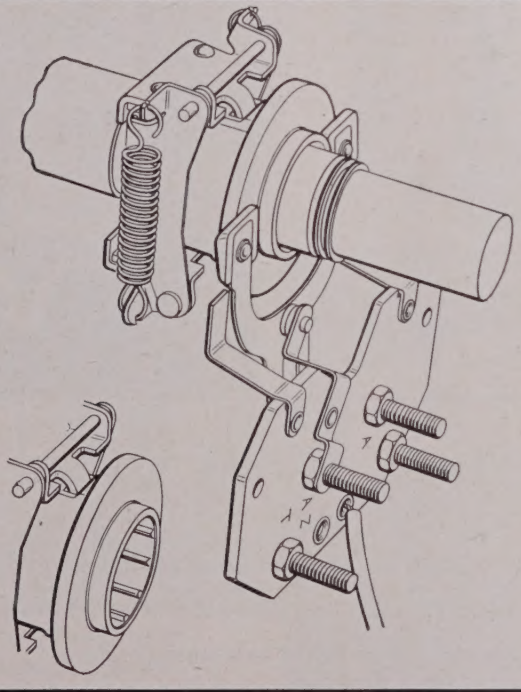
(LD3300)



F.H.P. motors are not expensive machines yet they have to be extraordinarily robust and absolutely reliable—often with very little maintenance. Designing for this kind of reliability at a competitive price is far beyond the realms of text-book formulæ. The things that distinguish a really successful design are often details—but important ones—based on knowledge won the hard way; from years of making motors and servicing them in the conditions under which they run.

This thing called know-how



A detail of this kind is the centrifugal switch on our split-phase and capacitor-start motors. The problem with such switches is to derive a snap action on both opening and closing from an operating force that increases and decreases smoothly. In the switch shown here the restraining springs are so designed that their leverage decreases as the fly-weights open. Thus, increasing centrifugal force meets decreasing resistance and, at the set speed, wins outright; the collar snaps back smartly opening the contacts at the base of the yoke. On test, switches have snapped open and closed well over 1,000,000 times without failure—a level of reliability typical of the motors themselves.

A·S·E·E
ELECTRICAL ENGINEERS EXHIBITION
EARLS COURT MARCH 21st–25th
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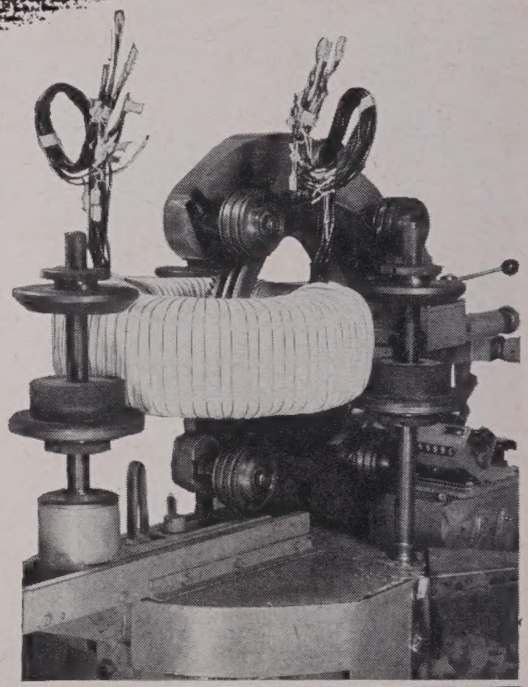
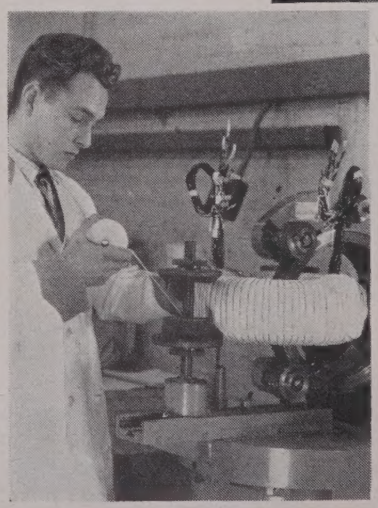
up to 30 VA

as well as Magnetic Amplifiers, Converter Transformers, Transductors, Inductors and Filter Toroids.

We produce toroids ranging in sizes from the smallest which has a minimum finished i.d. of .055 to cores having a maximum o.d. of 24″ and an overall height of 6″. Wire gauges from 10-48 swg.

AVEL TOROIDS are performance tested to laboratory standards.





1 Toroidal transformers up to 20 KVA are made. By using glass insulated wire and making full use of the good heat dissipation characteristics of the toroid, the operating temperature may be 300 — 350 degrees C.

2 One of the high speed miniature and sub-miniature toroidal winding machines which wind 48 swg wire at 1200 turns per minute.

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P6269

ASEA CAPACITORS WILL

REDUCE YOUR POWER COSTS

This 53 kVAr capacitor, type CTA2 oil-immersed di-electric, operates on a 3-phase 415 volt 50 cycle supply, and was installed to improve the power factor of the electric driving plant of a number of pumps at the Marlow Pumping Station.

consult-

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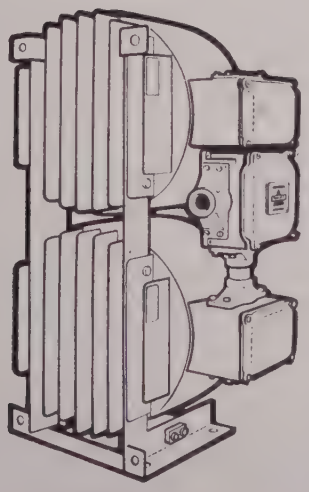
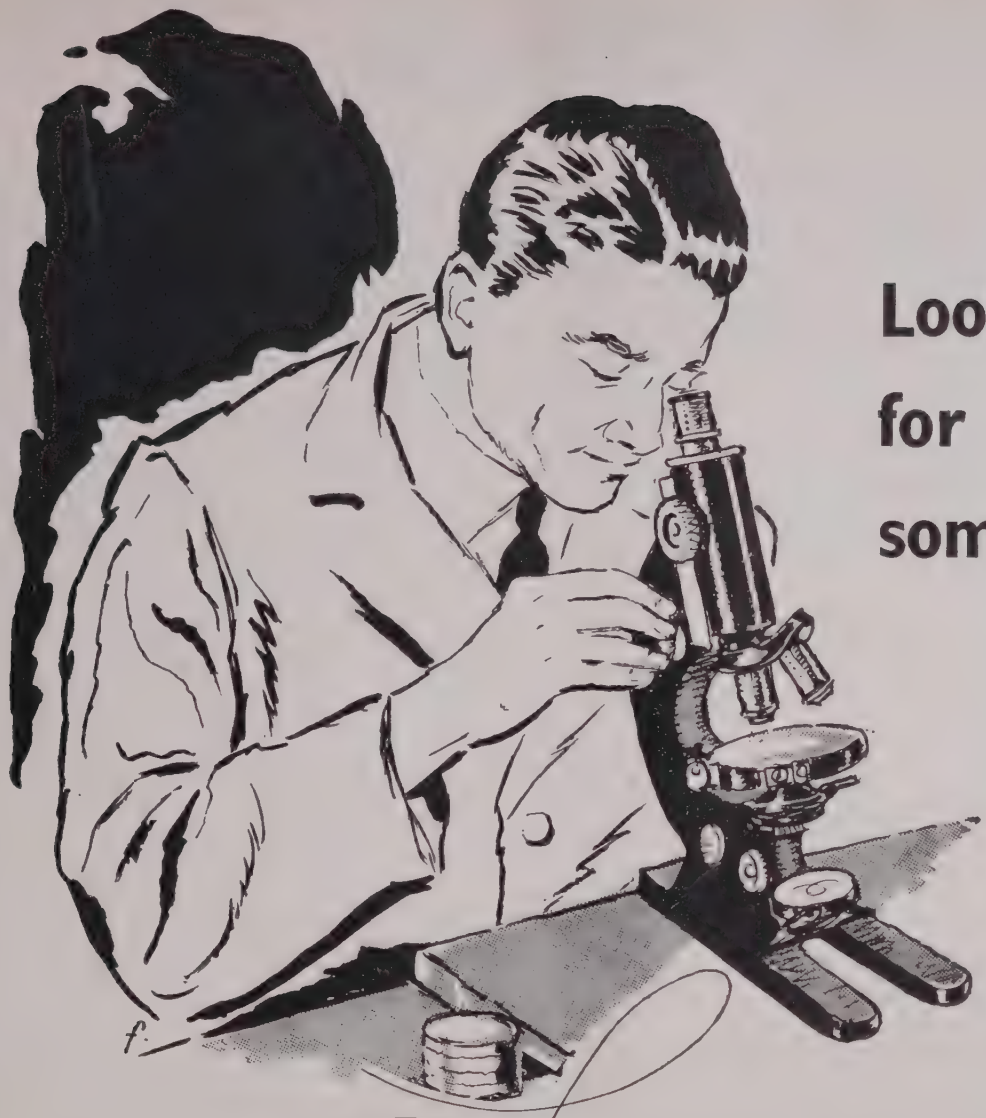


60 kVAr capacitor.

Are you sure that the highest possible proportion of the current you consume is converted into useful energy? ASEA Capacitors are an inexpensive method of improving power factor and achieving maximum economy. As with most capacitors, the efficiency exceeds 99.7%, but by using a cellulose base paper, *this efficiency is maintained in ASEA Capacitors* at almost all temperature conditions. This feature, coupled with the unique container design, gives ASEA Capacitors a long and trouble-free life.
Installation costs can be recovered in 12–18 months operation. An ASEA Capacitor is unobtrusive and requires no maintenance. It can be installed in a convenient corner and forgotten. It will be remembered gratefully when the power bills come in.

ASEA



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. . . is it

Superfine

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'LEWCOSOL' is available in sizes down to ·001 inch

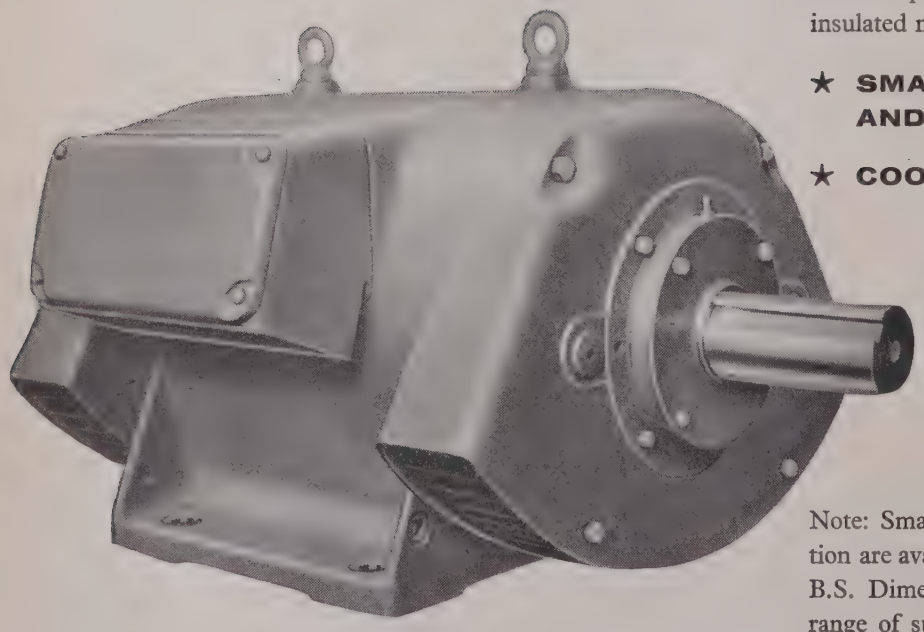
In response to the growing demand for high quality solderable superfine enamelled wires the range of Lewcosol wires has now been extended down to ·001 inch.
Manufactured under strictly controlled conditions on newly developed plant, these wires will find immediate application where size, solderability, and a consistently high quality are essential requirements.

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED

LEYTON · LONDON · E10

80-285 h.p. motors with Class 'E' Insulation

A new range of induction motors—
squirrel-cage, Type NC
and slip-ring, Type NW



Class 'E' insulation permits a temperature rise of 65°C in accordance with BS 2613/1957 and compared with conventional class 'A' insulated motors, these new machines have:

★ **SMALLER OVERALL SIZE AND COST** *for a given rating, with*

★ **COOL OUTER CASING**

available for early despatch

Note: Smaller motors with class 'E' insulation are available in the range 1-75 HP, with B.S. Dimensions. Also available is a wide range of suitable control gear.

for further details send for publication 3512-1

AEI

Motor and Control Gear Division
Associated Electrical Industries Limited
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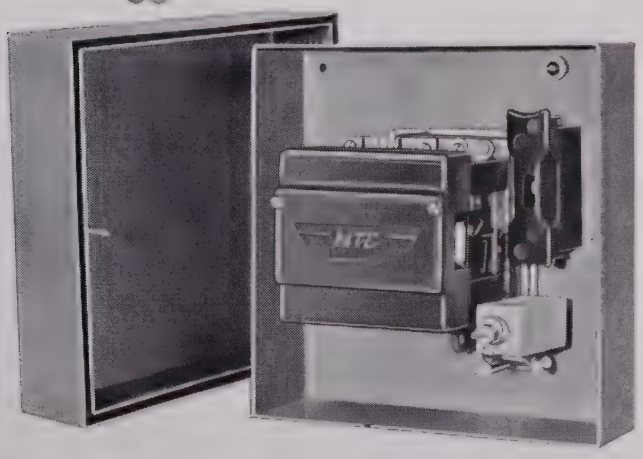

You want contactors that meet all the requirements of electrical heating circuits and M.T.E. have developed just that. Customer experience, built up over the years, has proved the dependability of M.T.E. contactors – now this special development is being produced to simplify the selection and installation of contactors for heating control.

Covering the range from 15 to 150 amps, M.T.E. Heating Contactors are available in single, double and triple-pole form, all contacts are fully protected by an arc barrier and cover in Alkyd moulding. Compact, heavy duty, unit constructed M.T.E contactors are silent in operation and fully comply with BSS.775 (1956). Front access and front wiring make for easy installation, whilst sheet steel dust and damp protecting enclosures incorporate knock-out conduit entries at top and bottom.

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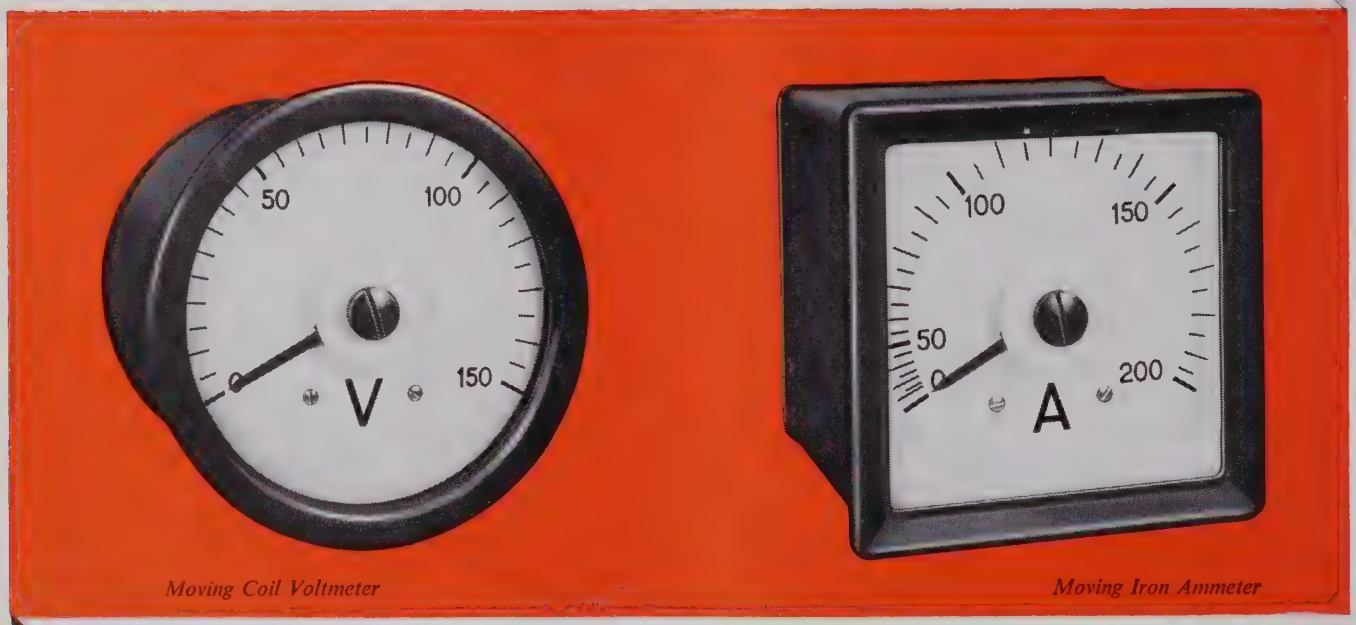
See the control gear components that interest you most on Stand K2 at the Electrical Engineers Exhibition in Earls Court March 21-25.

M.7.

Designer and operator agree on 'English Electric' 240° scale instruments for switchboard mounting...



Moving Coil Voltmeter *Moving Iron Ammeter*

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Their design permits 'on site' modifications or maintenance without disturbance of the original accuracy. Models are also available for direct wire remote indication.

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Moving Iron 4″, 6″, and 8″ scales; Square front and body, flush; Round front and body, flush and projecting.

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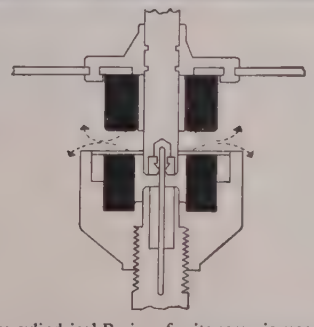
SANGAMO FIRST AGAIN!

NEW MAGNETIC FLOTATION OF DISC ASSEMBLY

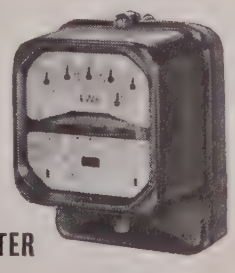
eliminates lower-bearing wear



Two cylindrical Barium-ferrite ceramic magnets, of high coercive force, act with opposing magnetic fields to float the disc completely on a magnetic cushion having a generous clearance of approximately $\frac{1}{16}$" in depth. These magnets, which are surrounded by Mu-temp metal to give full temperature compensation over a range —40°C to +80°C, act as weight neutralizers. Because there is no load or thrust there is virtually no bearing to wear or replace. Accuracy is sustained . . . and maintenance is eliminated.

* New "Floton" bearing gives complete magnetic flotation of disc assembly.
* Even longer life. * No maintenance.
* Unlimited sustained accuracy.

Sangamo are first in production with magnetic flotation of the disc assembly, completely eliminating bearing wear, giving even longer life and sustained accuracy to the world's longest life meter.



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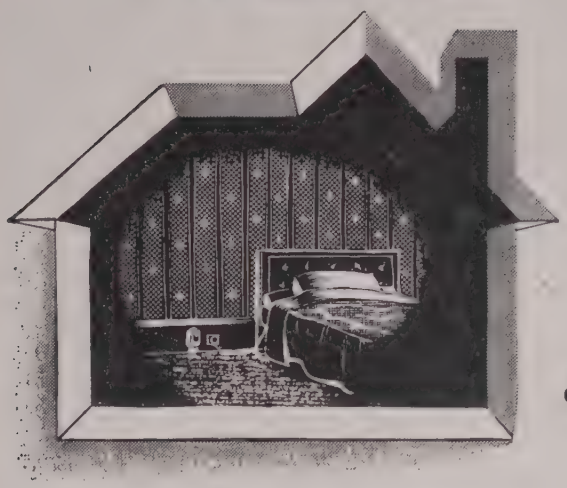
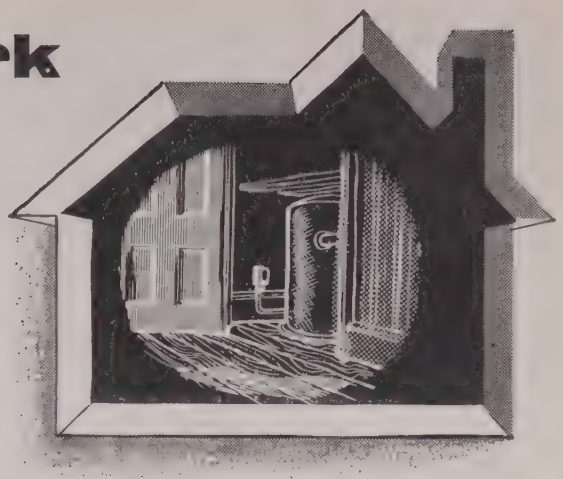
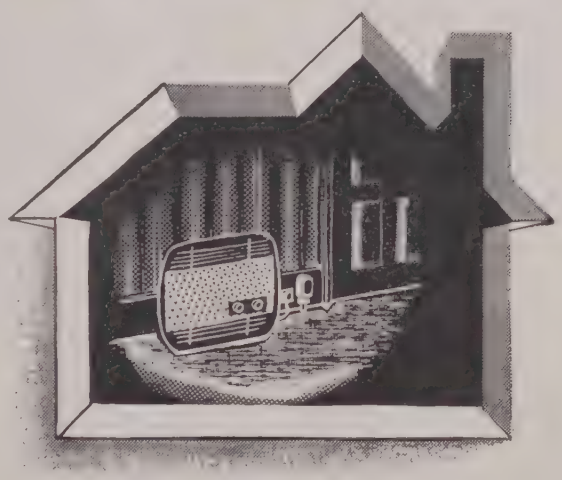
SW 122

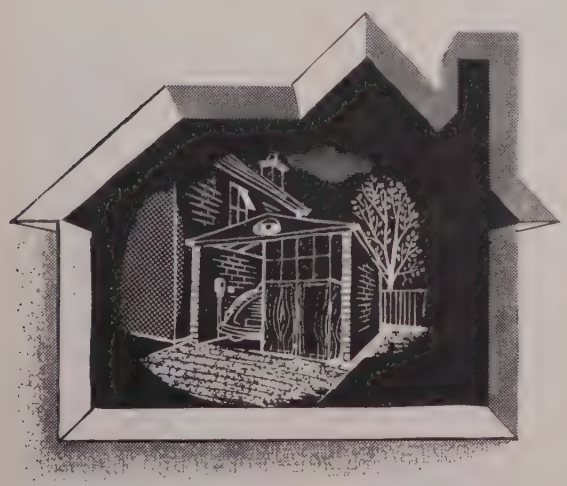
Put VENNER to work about the house



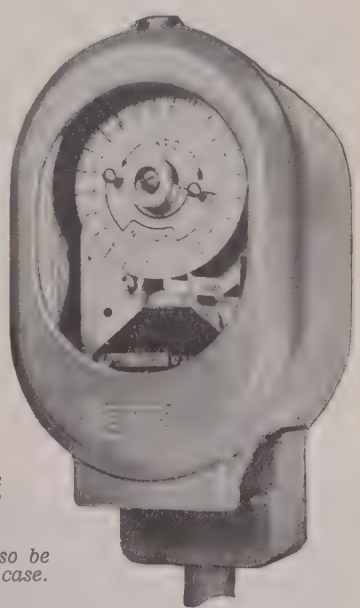




The average home today relies more and more on electrical equipment which can prove expensive if it is not properly controlled . . . immersion and under floor heating, for example. The Time Switch type MD1QP illustrated can switch an immersion heater off at night as well as on again in the morning while the family are still sleeping, saving power overnight but still providing hot water when it is needed. It can also control an electric blanket, porch or drive lighting, or a wireless set used as an early morning alarm.



Once set, the Time Switch needs no attention. The clock is electrically actuated; an external switch allows the appliance which it controls to be turned off when it is not needed. There are many variations of the Venner Time Switch, all described in our No. 1 series of leaflets, free on request.



A cable cover is available for conduit wiring. Rating 20 amps. 200/250v. A.C.

The Time Switch can also be supplied in an all-plastic case.

STAND No. C9
Electrical Engineers Exhibition
Earls Court, 21st—25th March

Venner Limited, Kingston By-Pass,
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Telephone: MALden 2442

VENNER Time Switches

The ingenious opposing-torque cross-cuts feature of Philidas self-locking nuts sets up a tension which is absolutely proof against all vibration. These locking nuts are completely unmoved by heat changes, oil infiltration or constant use under ever-varying stresses. They can be easily moved by a spanner when required. For complete details send for the latest catalogue.

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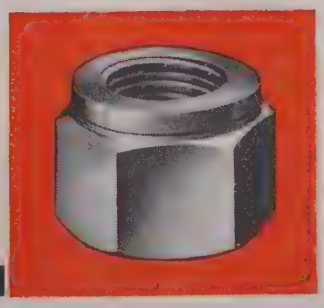

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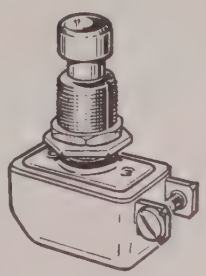

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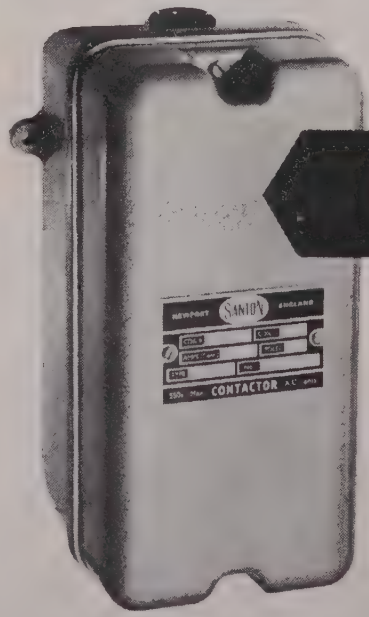

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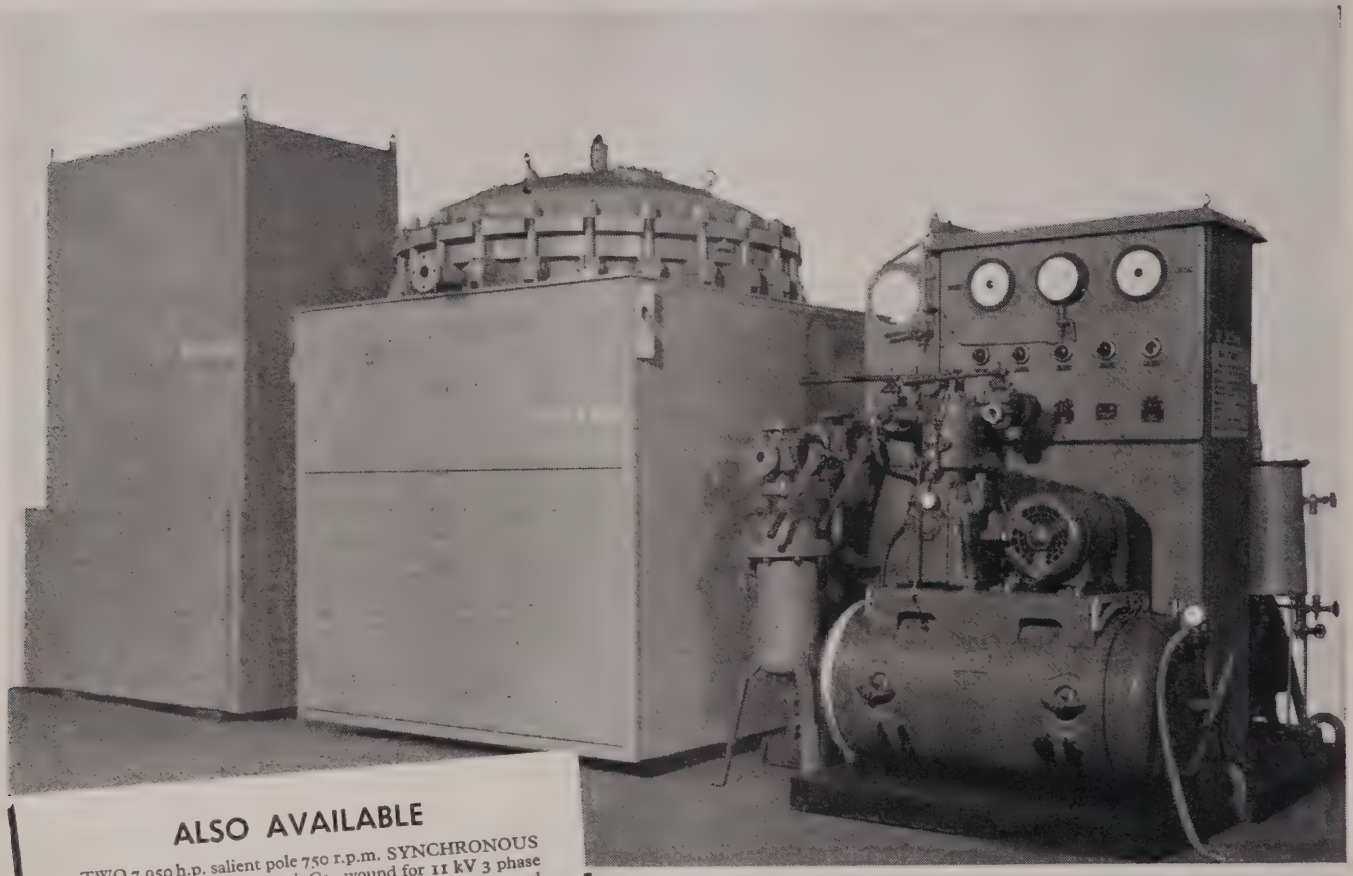

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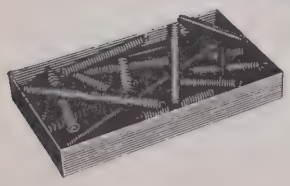

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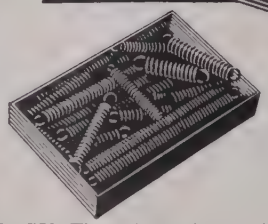

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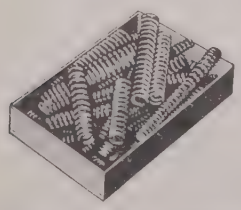

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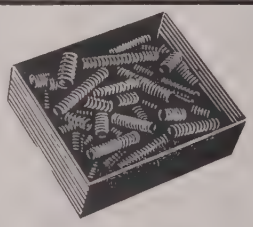

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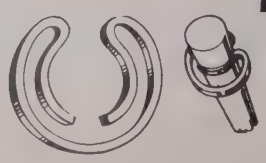

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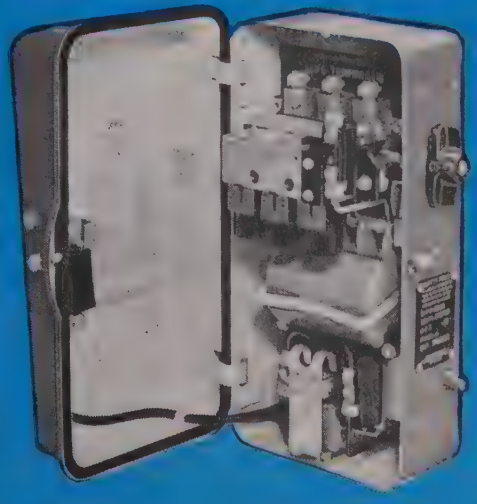

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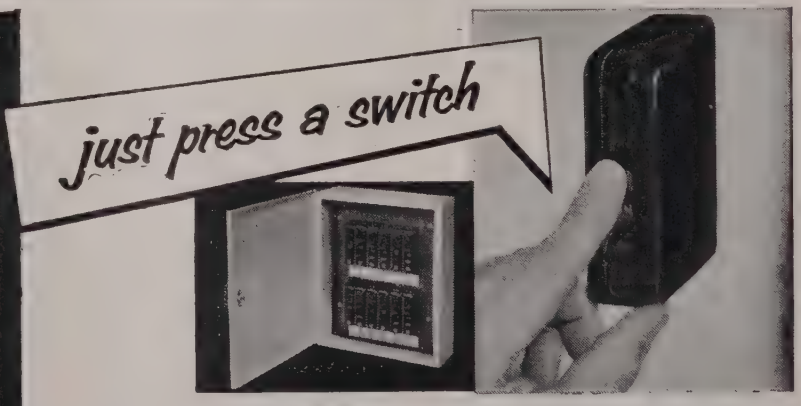

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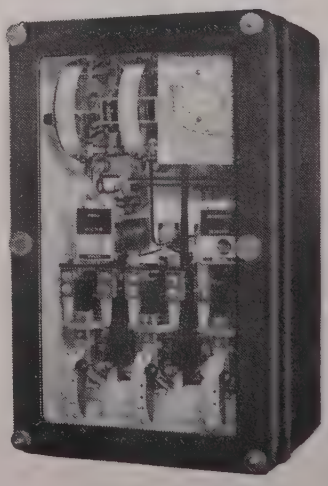

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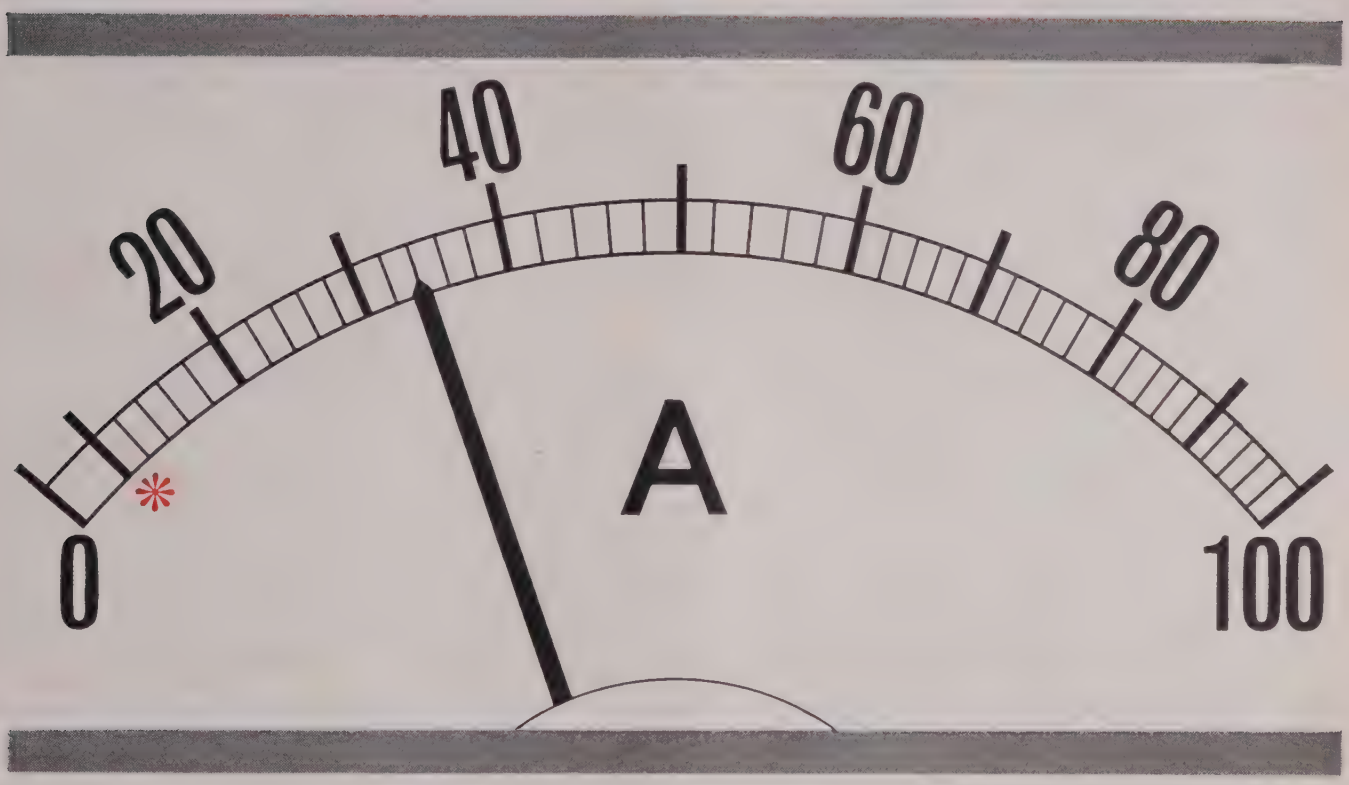

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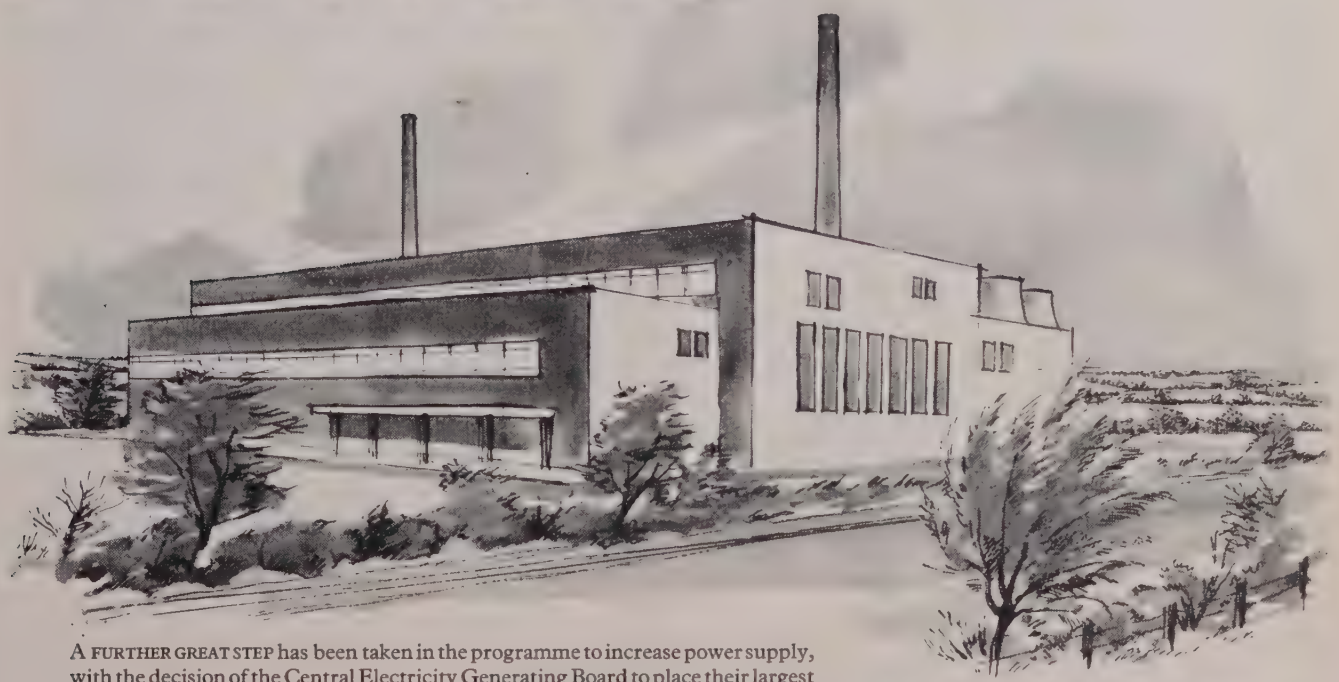

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ELECTRICAL REVIEW

Friday 3 March 1961 Volume 168 No 9

IN THIS ISSUE

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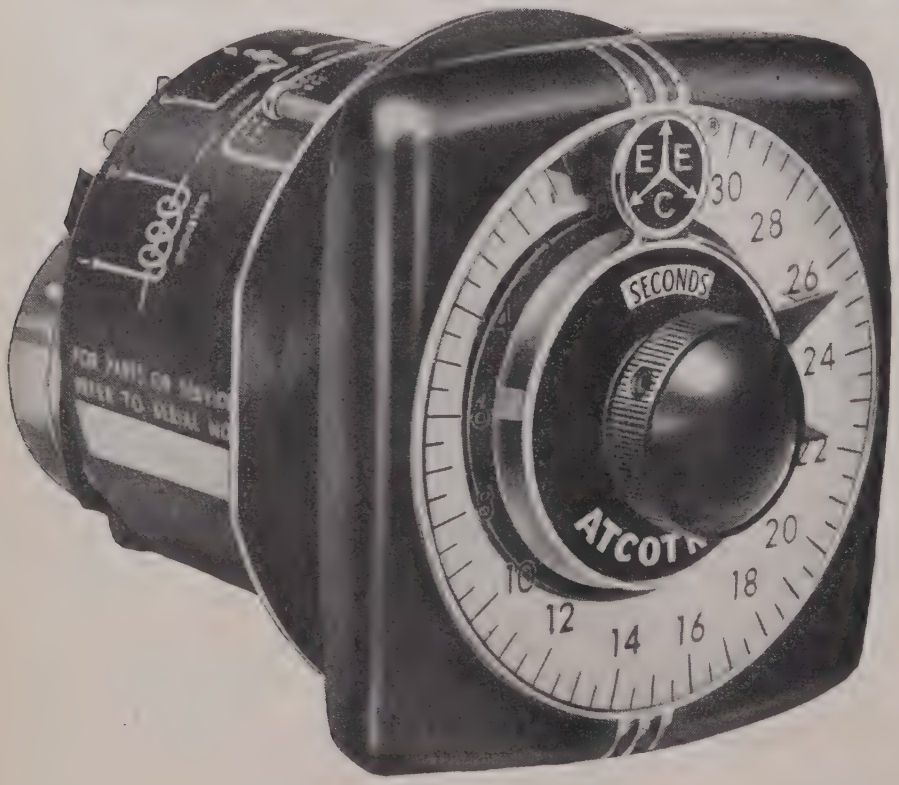

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ELECTRICAL REVIEW

3 March 1961 Vol. 168 No. 9 Established 1872

Plasma Physics

IT may seem rather curious that the nuclear fission process, which was unexpectedly discovered as recently as 1939 by Hahn, is the basis of the power production cycle in all nuclear power stations already built or so far contemplated, when the fusion process was discovered eight years earlier. It was considered that the fission process could be used in the production of plutonium for war weapons and reactors were built to produce it. Thus, as a by-product of weapons research, these Calder Hall prototype reactors led to the design of the present civil nuclear power stations, two of which, Berkeley and Bradwell, are to be commissioned this year.

No really serious work on controlled fusion power took place before 1950, but the success of the uncontrolled fusion reactor, the H-bomb, gave some stimulus and, at Geneva in 1958, over 100 papers were read on the subject. Fusion reactions were demonstrated by Lord Rutherford during a lecture to the Royal Institution in 1934, but where a beam of deuterons is fired at a cold deuterium target, the overall efficiency is very low, because of the loss of energy to the target electrons.

Thus, the only possible methods of producing an efficient fusion reaction are by some form of explosion or magnetic confinement of a hot plasma. The Russians have apparently succeeded in producing a fusion reaction by using chemical explosives to compress and heat a mixture of light elements. Unfortunately, the cost of the explosives required is prohibitive and, in any case, the explosion invariably destroys the apparatus. A toroidal discharge tube appears to be one convenient means of confining a hot plasma, but instability problems and high energy losses have caused work on this type of large apparatus to be temporarily abandoned. However, as a by-product of this work, impetus has been given to the development of magneto-hydrodynamic (M.H.D.) generation processes.

Another type of apparatus which is receiving serious consideration is the magnetic bottle or mirror. Unfortunately, the external energy required to produce the plasma is many times larger than that required to produce the pinched discharge in a toroidal machine. However, the magnetic mirror has the advantage that the plasma appears to be more stable. In fact, the plasma in the first two stages of the Livermore three-stage magnetic compression mirror machine appeared to remain stable about 1,000 times longer than calculation suggested.

This seems to be the first practical achievement which has so far occurred in the efforts to produce an economic fusion power system, and

this unexpected discovery suggests that it is necessary to broaden the field of research and carry out as many basic experiments as possible. As Professor P. M. S. Blackett said in the Thomas Hawksley Lecture to the Institution of Mechanical Engineers last week, " every suggestion from theory about a useful experiment to perform should be followed up." An experimental tube, filled with a heavy gas to slow down the motions of the plasma, is being used at Imperial College and has already produced results.

When considering the final form of a fusion power reactor, Professor Blackett concluded that if an economic reactor was ever built, it would probably be very large indeed. This may mean that after initial research into essential fusion phenomena, large experimental apparatus will have to be built because, although apparatus of any size can be constructed, the essential ingredients of the reaction, the atoms, cannot be scaled.

NUCLEAR POWER RESEARCH

A big improvement will be made in the facilities available for nuclear power research and development in this country when the Berkeley Laboratories of the Central Electricity Generating Board are opened in three months' time. These comprehensively equipped laboratories are costing £2 million to establish and with the scientific staff already recruited and the equipment provided it will be possible to undertake research in all fields related to nuclear power generation.

Obviously, a continuing and substantial research and development programme is required to establish nuclear power as an economic and reliable source of electricity supply. The new laboratories will be the centre of the C.E.G.B. nuclear research and development with emphasis on the underwriting of the success of the present stations and those to be constructed in the immediate future. At present operational experience of nuclear power stations in this country is limited to Calder Hall and Chapelcross, where the reactors differ in many important respects from those to be operated by the Board.

With the operational experience that will be gained by the Board, which is potentially the largest owner of nuclear plant in Britain, and from the work of the laboratories, the Board will be in a position to determine what advanced nuclear systems are likely to be appropriate to the electricity supply industry in the future.

B.E.A.M.A. PROPOSALS

The circumstances in which the electrical industry finds itself today have necessitated a good deal of thought by the Council of the British Electrical and Allied Manufacturers' Association about the structure and methods of operation of the Association. Already there has been some internal reorganisation but now the " top structure " is being attended to.

Hitherto the presidency of the B.E.A.M.A. has been an honorific job and its occupant was not necessarily in the electrical industry; in fact the 17th Earl of Derby was president for many years. The idea (as will be seen from the report on page 387) is that in future the president shall be a prominent electrical man who will take an active, continuing interest in the affairs of the Association and act as chairman, the title of chairman being abolished. This and the other alterations proposed will, it is believed, better equip the Association to handle the industry's affairs and exercise an influence in the national economy.

PRICES AND COMPETITION

In his speech at the I.E.E. annual dinner the Minister of Power (Mr. Richard Wood) again raised the question of fuel price policy. He said " the Government must be responsible for seeing that competition between electricity and the other power industries is on a basis of prices which properly reflect the relevant costs." This might be held to suggest that electricity is not competing on this basis. The supply industry is, however, one of the national undertakings which consistently shows a surplus and meets anything from a third to a half of its capital needs from revenue.

While there may be room for argument about the incidence of charges upon different classes of consumer, it would be hard to prove that the general price is uneconomic. Electricity is certainly cheap: but why shouldn't it be? Is there a feeling about that this successful nationalised industry should help to keep the less profitable ones?

A " SUPRA " INSTITUTION

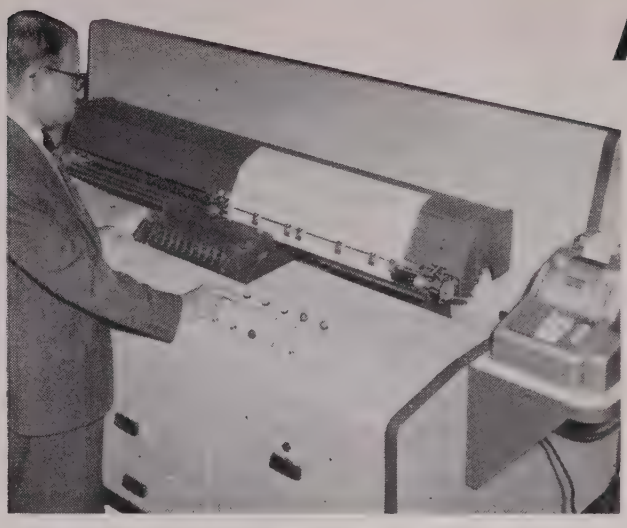
Last year, Sir Herbert Manzoni, President of the Institution of Civil Engineers, said in a letter to corporate members that the ultimate aim was to have one society whose corporate members should be chartered engineers. Sir Hamish MacLaren, on the other hand, has maintained that the wide scope of electrical engineering necessitates a separate institution and this sentiment was reiterated at the I.E.E. annual dinner last week.

In various speeches made last year, Sir Hamish did, however, suggest that some aspects of the three senior institutions' affairs could well be combined, for example a joint public relations department could be formed. Last week, he expanded upon this suggestion and envisaged a " supra " Institution of Engineers to which all corporate members of the senior institutions would belong.

This would appear to mean that instead of dealing with three different councils, the Government could consult a single joint body which would obviously have full powers of negotiation on such matters as registration, etc., in direct contrast to the Engineers' Guild, which is not a chartered body and does not have the backing of every chartered engineer. It is to be hoped that the discussions at present taking place between the three senior institutions will soon produce concrete proposals.

AUTOMATIC DATA LOGGING

By J. E. O'BREEN, F.Inst.F., M.I.Mech.E.*



The printing-out desk of the Panellit data-logging equipment, as installed at Northfleet power station

Control cubicle for the data-logging system

Application to Power Stations

A considerable number of conventional instruments, particularly the recording type, are used in all power station control rooms. Most of these can be eliminated by the use of an automatic data-logging system with alarm facilities. The installation of such a system at Northfleet power station is described in detail

THE object of a data-logging system is to collect all data together in a digital form on a log sheet, thereby eliminating the necessity for a considerable number of conventional instruments, particularly of the recording type. This log sheet can be somewhat similar in form to the sheet generally filled in at regular intervals by the shift engineer from readings taken of the various indicating and recording instruments. It takes the engineer a considerable time to put down all such readings, but the data logger measures and records each operating point in 1/5th second. At any required time interval the special electrical typewriter or compu-printer embodied in the system will type out all the values in a predetermined sequence.

However, disturbances in the operation of the plant can start between two consecutive loggings which are normally taken at intervals of 60 minutes. For this reason all data are scanned continually and compared with predetermined values. If any one reading exceeds the predetermined limits of variation in its value, the system will take immediate action by giving an alarm, visible and audible, and by printing-out on a separate strip printer the time, the condition which is abnormal, and the actual value of this condition. Thus, the operator is immediately made aware of what is happening and can take corrective action if he considers that this is advisable. When the condition reverts again to normal the operator will also be advised by the alarm system.

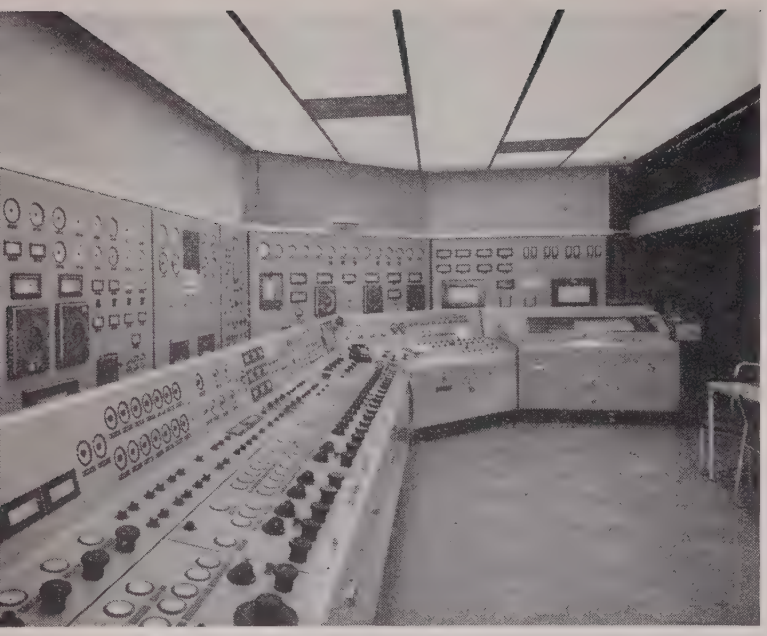
In the *Electrical Review* of 26th August, 1960, the main features of the Northfleet power station were described and brief reference was made to the new ideas followed in the methods of recording operating data. Although it was not intended to make the station completely automatic, it was decided to install a data-logging system, designed and made by Panellit, Ltd., as a first step in this direction. The following is a more detailed description of the Panellit 607 data-logging equipment, as in operation at Northfleet. The system is designed to monitor a maximum of 250 inputs, each representing an instrument reading, although only 170 inputs are so far in use. As a number of these points are used more than once, the actual number of points monitored total 134.

All the input signals are of an electrical value and are supplied by measuring and detecting instruments which include chromel-alumel thermocouples, pressure transducers, resistance and differential thermometers, current and voltage measuring instruments, and other apparatus such as pH, CO_2 and oxygen meters. The input signals are used for different purposes as follows:

(1) *Alarm Scan*

This equipment will continuously scan a maximum of 50 points known as the alarm points, except during the period that an automatic or manually demanded log cycle (see section 2) is in progress. The input signals from the alarm points are selected in a predetermined sequence and compared with corresponding high and low limits.

* Managing Director, James Gordon & Co., Ltd.



Unit operating station at Northfleet showing the data-logging equipment at the right-hand end

As soon as a signal is found to be outside the preset limits an alarm is initiated, both visible and audible. This signal is then measured and the value printed in red digits on the strip printer.

As the equipment installed is not a computer which can take action in the event of an alarm, the operator, on being alerted, has to decide what should be done to correct the faulty condition. When the abnormal condition has ceased, and the signal has been brought back inside the preset limits, it is again measured, translated and printed —this time in black digits, on the strip record chart. After that it will of course appear in black on subsequent hourly logs. Each print-out on the strip chart will be preceded by the time in hours and minutes, followed immediately by the particular point number and the measured value.

(2) *Hourly Log Cycle*

In addition to the continuous scan, the equipment will conduct an hourly scan of up to 100 points known as the hourly log points. This scan is automatically initiated by a signal from the clock unit. If another log cycle is in progress, the hourly log will commence as soon as the other cycle is completed.

Each of the log points is selected in a predetermined sequence, measured, translated and printed by the automatic typewriter, known as the compu-printer. Some of these log points are also included in the alarm scan and therefore have to conform with high and low limits. If at the time of the hourly log one or more of these happen to be outside the alarm limits, they will be printed in red, whereas all other points are printed in black.

(3) *Trend Log Point Cycle*

A further scan includes 100 points known as the trend points. The log cycle of these trend points is initiated manually, and this scan then commences as soon as the alarm or hourly scan is completed. Each of the points is monitored sequentially and the point value is printed-out by the compu-printer. The trend record is preceded and followed by a blank line and contains the code letter T and the time of the scan. These two columns are printed in red whilst the value of each point is printed in black.

Manual Facilities

The above scans take place automatically and, in addition, a number of manual operations are available as follows: (1) Print-out at any required time of the hourly log points, (2) print-out of the trend points, (3) print-out of all the alarm points which are outside the preset limits, (4) print-out of all high set point values, (5) print-out of all low set point values. These controls may be operated at any time except during a log cycle. The records of the log points and trend points are produced by the compu-printer in the standard form while the alarm and set point records are recorded on the strip printer in the form of a code letter, followed by the time, the point number and the value for each point scanned.

As an additional facility for the operator, there is available at any time, except during the log cycles, an eight-digit illuminated display unit together with a dial selector which allows any input point or set point to be monitored and its value to be displayed. This digital display unit consists of a code letter (for alarm, hourly or trend point), a two-digit point number, a sign digit which may be plus, minus or an asterisk, and four digits for the point value.

As the data-logging system is still something new for British power stations, the Central Electricity Generating Board considered, when deciding to install it at Northfleet, that it would be advisable to have in addition a full complement of indicating instruments, so that both methods of manual supervision could be compared. However, a number of recording instruments, which would normally be installed, have been omitted. It will be clear that with the use of a data logger and alarm system most of the usual recorders and some of the indicators can be eliminated. This will result in a considerable saving in first cost of such equipment. Further, control panels and desks can be much smaller, so that control rooms too can be reduced in size, which in turn results in a saving in the building cost.

No claim is made for reduction in maintenance; although the instrument engineer will have fewer recording instruments to attend to, he will have to spend some time in supervising the continuous satisfactory operation of the scanning, alarm and data-logging system. The recording and indicating instruments supplied to the Northfleet station are nearly all of Elliott Bros. (London), Ltd., manufacture.

Instrumentation

The main feature of the instrumentation is that the majority of the instruments supplied had to be of the electrical transmitting type in order to provide a suitable signal to the Panellit data-logging system. In the case of temperature measurement, this presented no problem as standard thermocouples and resistance thermometers performed this function adequately in addition to providing the signal for the temperature measuring panel mounted instruments.

In the case of pressure and suction points, wherever the range was above 6in w.g. the standard Elliottel transmitter was used, providing a 0–10 mA signal which can be fed to the data-logging system and also to panel mounted

instruments. Where very low differential pressures had to be measured, and of these there are approximately 30 points per boiler, it was necessary to modify the standard Elliottel transmitter to incorporate a low range mercury bell for these low ranges.

Due to the data-logging system, recorders were supplied for only the most important measurements, namely final steam and reheat steam temperature, steam flow, air flow, and feed water flow, in addition to conductivity and eccentricity recorders on the turbine supervisory equipment. There are, however, a considerable number of indicating instruments which duplicate the majority of points of measurement on the data-logging system.

The instrument panels consist of various sections made up of boiler panel, boiler desk, turbine panel, turbine desk, turbine supervisory panel and generator panel, as well as the boiler master panel incorporating the steam and water temperature and flow indicators and recorders. There are about 150 measuring points on each boiler and 200 on each turbine, and this number includes all points of measurement not only for those for temperature and pressure, etc.

As mentioned in the 26th August issue, the automatic boiler control installed at Northfleet is the pneumatic system supplied by James Gordon & Co., Ltd. At the time the station was planned the Gordon-Swartwout electronic control was still in its development stage, and as a reliable and efficient system which had proved itself in other stations was required, the Gordon pneumatic system was decided upon.

Introduction to

PLASMA PHYSICS

By W. B. THOMPSON, B.A., M.A., Ph.D.

Author's summary of a lecture entitled "A Comprehensive Introduction to Plasma Physics" which was delivered at a meeting of the Electronics and Communications Section of the Institution of Electrical Engineers on 17th February

PLASMA physics is the modern name for the study of the physics of ionised gases. Although the name is new the subject is of quite respectable antiquity, and a good case can be made for deriving modern molecular, atomic and nuclear physics from the study of the conduction of electricity through gases. Only quite recently, however, have the characteristic dynamical properties of the plasma attracted attention. Interest arose first among astronomers who recognised that most of the matter in the universe is ionised, hence any serious investigation of the cosmos requires an understanding of plasma dynamics. Technological interest has been aroused in the possible applications of the peculiar dynamical properties of the plasma to such problems as the propulsion of vehicles through interplanetary space, the direct conversion of heat into electricity, and the controlled release of thermonuclear energy from an intensely heated deuterium plasma confined by a magnetic field.

The Positive Column

The plasma which has been longest studied is the positive column of a d.c. arc, the glowing mass of gas extending up from the anode. On entering this region, electrons which have been accelerated from the cathode make ionising collisions with neutral atoms, thus producing new electrons and being scattered, so that instead of streaming toward the anode the electrons move in a random fashion and may be described as a hot gas at some temperature, Te, greatly in excess of that of the neutrals and the ions. Their random motion carries the electrons to the walls of the confining tube and although they may be retarded by collisions with neutrals, electrons arrive in sufficient numbers to give the wall a negative charge and produce a radial electric field in the body of the discharge. Ions are then accelerated toward the wall by this electric field until the flux of ions and electrons becomes equal and no net current flows to the wall, electrons and ions recombining there and returning to the tube as neutrals. This diffusion process may be described by balancing the three forces acting on the electrons, the pressure gradient, the electric field and the friction due to collisions with neutrals, i.e.

$$-\nabla\, nkT_- - ne\, E_r - \tau_- nv = 0 \qquad (1.1)$$

where n is the electron density, T_- the electron temperature, $-e$ the charge, E_r the radial electric field, τ_- a friction coefficient and v the radial drift velocity.

The ion motion is described by a similar relation, although here the pressure is negligible and the charge of the opposite sign

$$ne\, E_r - \tau_+ nv = 0' \qquad (1.2)$$

Since the plasma is electrically (approximately) neutral and there is no net current, $n_+ = n_-$, and $v_+ = v_-$. By adding these two relations

$$-\nabla\, nkT_- - (\tau_- + \tau_+)\, nv = 0 \qquad (1.3)$$

or for uniform temperature

$$nv = \frac{kT_-}{\tau_- + \tau_+}\, \nabla n = D_a \nabla n \qquad (1.4)$$

the usual ambipolar diffusion relation.

Magnetic Effects, Lorentz Forces and Confinement

If the positive column is placed in a magnetic field, additional forces act upon the electron gas; for since the electrons are streaming with an average axial velocity w, the sum of the Lorentz forces

$$\mathbf{F} = \Sigma e\, \mathbf{w} \times \mathbf{B}$$

does not vanish, but has a radial component

$$F = ne\, (w \times B)_r \qquad (2.1)$$

When this is added to (1.1), and the derivation of (1.3) repeated, there results

$$-\nabla\, nkT_- + \mathbf{j} \times \mathbf{B} - (\tau_- + \tau_+)\, n\mathbf{v} = 0 \qquad (2.2)$$

If **B** is directed around the tube, $\mathbf{j} \times \mathbf{B}$ may act radially inward; and if **B** represents the field produced by **j** itself, this will happen. It is then possible for $\mathbf{j} \times \mathbf{B}$ and ∇nkT to balance each other so that radial drift $v = 0$, a process which can occur provided

$$\frac{Ne^2}{mc^2} \cdot \frac{1}{2} \cdot \frac{mw^2}{kT_-} > 1$$

and is responsible for the pinch effect, where N is the number of electrons per unit length. The plasma is then confined by the magnetic field.

Magneto-hydrodynamics

The state of the magnetically confined gas may be represented macroscopically as a balance between the pressure gradient ∇p and the ponderomotive force $\mathbf{j} \times \mathbf{B}$, a representation which suggests that for many purposes the plasma may be represented as a conducting fluid and its motion described hydrodynamically

$$\frac{D\mathbf{u}}{Dt} = -\nabla p + \mathbf{j} \times \mathbf{B} \qquad (3.1)$$

Some relation is needed to relate **j** to the fields and it is usual to use an appropriate form of Ohm's law,

$$\mathbf{j} = \sigma \mathbf{E}^{\star} \qquad (3.2)$$

The electric field $\mathbf{E}^{\star}$, however, is the force acting on a unit charge moving with the fluid velocity, **v**

i.e. $$\mathbf{E}^{\star} = \mathbf{E} + \mathbf{v} \times \mathbf{B} \qquad (3.3)$$

the addition being the Lorentz force in the magnetic field.

It is now possible to understand direct conversion, plasma propulsion and magnetic confinement.

Applications

Magnetic confinement, the isolation of a hot plasma, is achieved if $\mathbf{j} \times \mathbf{B} = \nabla p$. This requires that the magnetic field and the current shall lie in closed surfaces of constant pressure. Since the fields are solenoidal, the simplest configurations are toroidal. Many such may be envisaged, but most are unstable, the magnetic surfaces rippling until the plasma escapes.

The force $\mathbf{j} \times \mathbf{B}$ can also accelerate the plasma to high velocities, and may be used to produce the low thrust, high specific impulse drive desirable for interplanetary flight.

This process may be reversed. Across a plasma flowing with velocity **v** across a magnetic field **B** appears an e.m.f. which may produce a current in an external circuit so that energy is extracted from the gas directly as electricity.

Basis of Magneto-hydrodynamics

For most characteristic magneto-hydrodynamics behaviour the resistance should be low; however, for normal hydrodynamic behaviour mean free paths should be short, apparently contradictory requirements. A very diffuse gas may exhibit medium-like behaviour in which the localising effect is not frequent atomic collisions, but the orbits of free charged particles in a strong magnetic field. These orbits form helices about the field line, particles rotating with a frequency $\Omega = \frac{eB}{m}$, in circles of radius $r_L = \frac{v_{\perp}}{\Omega}$, where $v_{\perp}$ is the velocity across the field line. If $v_{\parallel}$ is the velocity along the magnetic field line, and this is random about some mean $V_{\parallel}$, then the stress tensor is not simply a scalar pressure p, but though diagonal, has independent components $p_{\parallel}$, $p_{\perp}$ in directions parallel and perpendicular to the magnetic field. If the Larmor radius is very small, the orbits drift together with a velocity $\mathbf{V}_D$ such that

$$\mathbf{E} + \mathbf{V}_D \times \mathbf{B} = 0$$

and by summing over many particles we discover a macroscopic description of the plasma as a perfect conductor with non-isotropic pressure. An important new consequence is that a plasma may be confined between regions of strong field, the equilibrium being determined by

$$\frac{\partial p_{\parallel}}{\partial x_{\parallel}} + \frac{1}{B}\frac{\partial B}{\partial x_{\parallel}}\left[p_{\perp} - p_{\parallel}\right] = 0$$

REACTOR PHYSICS EXPERIMENTS

A NEW low power reactor called VERA (Versatile Experimental Reactor Assembly) started operating for the first time at the Atomic Weapons Research Establishment, Aldermaston, on 22nd February. It is being used in reactor physics experiments to improve nuclear data and methods of calculation for fast critical assemblies. More information on these systems is required for many problems relating to the safety of storage and processing of fissile materials and for the fast reactor development programme.

The reactor includes a core region of thin-walled steel fuel tubes surrounded by a natural uranium reflector, the whole forming a cylinder 4ft high and 5ft in diameter. The fuel tubes are loaded with fissile and diluent material plates 1·7in square and $\frac{1}{8}$in thick. By appropriate loadings the composition and size of the reactor core may be varied to examine the nuclear importance of materials over a wide range of neutron energies.

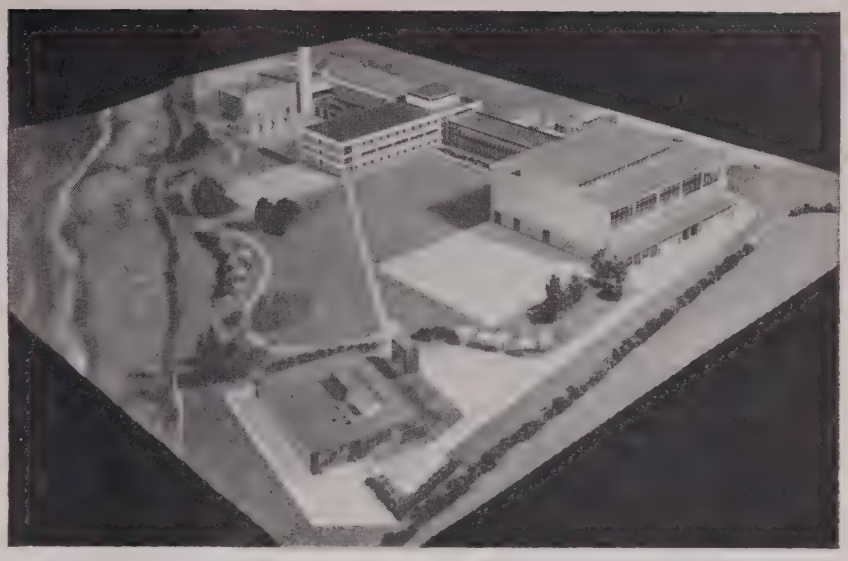
The reactor is designed to separate into two parts for safe loading, the two halves being brought slowly together by remote control. An accelerator associated with VERA enables neutron bursts to be generated for measurements of reactivity and time-dependent behaviour. The reactor is located in a large concrete cell which is sealed during operation. As the power will not exceed 100 W special cooling is not required.

This work forms part of a programme of experimental and theoretical nuclear data studies at the A.W.R.E. and is co-ordinated with fast reactor work in progress at other establishments of the United Kingdom Atomic Energy Authority.

Engineering Equipment Users' Association

This Association has recently published a booklet describing its objects and organisation. Copies can be obtained, free of charge, from the general secretary at 20, Grosvenor Gardens, London, S.W.1.

BERKELEY NUCLEAR LABORATORIES



Model of the Berkeley nuclear laboratories

THE official opening of the Berkeley Nuclear Laboratories, adjacent to Berkeley nuclear power station in Gloucestershire, is to take place on Monday, 29th May. This will be followed by a four-day international conference on the properties of reactor materials and the effects of radiation damage. So far, more than 100 scientists from all over the world have accepted the invitation to attend the conference, which will cover such subjects as measurement of damage, flux and neutron spectra, materials and dimensional stability. Formal sessions of the conference will be held in the Great Hall of Berkeley Castle by courtesy of Capt. R. G. W. Berkeley.

Scope of Research

The Berkeley Laboratories of the Central Electricity Generating Board have cost more than £2 million to build. They are comprehensively equipped and are capable of undertaking research in all fields related to nuclear power generation. The staff will work in close co-operation with the technicians responsible for the operation and maintenance of all the Board's nuclear power stations, and in addition to operational research, the laboratory programme will have a necessary proportion of fundamental research work. There will not, however, be any duplication of the work being carried out by the United Kingdom Atomic Energy Authority.

The staff of the laboratories have been recruited over the past two years and will total 170 when work starts, rising quickly to about 350. Various members of the staff have already begun their scientific programmes in university departments and various industrial laboratories; they will transfer to Berkeley as soon as possible. Thus the work of the Berkeley Nuclear Laboratories has, in fact, already started. In particular, some important research on graphite has been in progress for nearly two years at a special laboratory in London.

The laboratories, which cover an area of about 100,000 sq ft, have three main divisions, viz. engineering, physics and reactor materials. The engineering hall has a headroom of 60ft to permit the erection of the largest reactor rigs; fuel element heat transfer work and fuel element testing and development will be carried out here.

The main laboratory block occupies about one-third of the total working area. It contains a series of "caves" and "cells" in which operations on highly radioactive irradiated fuel elements can be made by remote control and without hazard. Apart from providing assistance to nuclear power stations during the commissioning of civil reactors, the physics division will investigate prototype reactor cores and develop improved methods of measurement.

In the interests of safety the graphite moderators in the reactors in each of the civil nuclear power stations will be monitored throughout its life. Measurements will be made of stored energy, dimensional and strength changes in thousands of graphite specimens installed at significant points in each reactor core.

An instrument section will work primarily on nuclear radiation detectors and "in-pile" measuring techniques where there are important gaps in present knowledge. The physics division will also be equipped to carry out a wide range of more "classical" measurements involved in the work of the laboratory. The materials division will have facilities for investigating all materials peculiar to nuclear power stations. The behaviour of fuel elements is a central problem since their performance is a determining factor in the economics and, indeed, the success of the civil stations.

Examination of Fuel Elements

Remote handling facilities can deal with about 1,000 fuel elements a year of which a full examination will be made to determine causes of failure, predict the onset of failures (an important piece of information for reactor operators) and work towards improved types of fuel element. This examination programme will be carried out in conjunction with the U.K.A.E.A. which supplies the fuel and will undertake the examination of a similar number of fuel elements.

A study of the reaction between gas and graphite under dynamic conditions is also to be made since this may be a determining feature in the life of the reactor and it may also affect the feasibility of advanced types of reactors, particularly those working at the high temperatures visualised for the future generation of nuclear power stations.

The Breakdown of Sphere-Gaps

By E. KUFFEL, M.Sc., Ph.D., A.Inst.P., and A. S. HUSBANDS, B.Sc.(Eng.), M.I.E.E.

Authors' summary of four papers* which were presented at a meeting of the Measurement, Supply and Utilisation Sections of the Institution of Electrical Engineers on 21st February

CALIBRATED sphere-gaps, with one sphere earthed, are frequently used for the measurement of high voltages, since the gap breakdown voltages are reasonably consistent under suitable test conditions. The conditions for a prescribed accuracy of measurement are not readily calculated, but they have been determined from experimental results. Similarly, the breakdown voltages of the gaps have not been calculated, so that the voltages must be predetermined or calibrated by some other means. A number of experimental calibrations have been correlated and the recommended calibration tables and test conditions have been revised by the International Electrotechnical Commission (I.E.C. Publication 52:1960) and by the British Standards Institution (B.S. 358:1960).

There is a lack of quantitative data concerning the influences on the breakdown voltages of various factors. These factors include the effects of:—(a) The irradiation of the air-gap to produce additional free electrons; (b) the atmospheric humidity; (c) variations of the clearance from the spheres to other nearby objects; and (d) the polarity of the high-voltage sphere when direct voltages are applied across the gap. Investigations have been made mainly with direct voltages in order to evaluate the changes in the breakdown voltages which resulted from certain changes in the test conditions.

Irradiation

The initiation of the breakdown process requires a definite minimum voltage between the two spheres, and it depends upon the presence at the critical time of some free electrons in the effectively stressed volume of air between the electrodes. Such electrons are formed spontaneously in the normal atmosphere, but they are short-lived as free electrons. Their natural rate of formation (per unit volume) may be too low to provide the favourably placed electrons which are required for a breakdown at the minimum voltage. This effect is significant when the gap is short and contains only a small stressed volume of air. It is particularly noticeable when the applied voltage has a short duration (e.g. impulse voltages); then the breakdown voltage is increased and it has a statistical variation above the minimum value. The higher voltage has the effect of increasing the effectively stressed volume of air, and also it tends to protract the time for which the voltage wave exceeds the minimum value. However, a similar effect is noticeable with the longer durations of alternating (50 c/s) or direct voltages applied to very small gaps (e.g. for a 1 mm gap the direct voltage had to be applied for several seconds to ensure a breakdown at a voltage within 1 per cent of the minimum). Thus, an external means for producing additional free electrons is necessary to obtain consistent results with small gaps. B.S. 358 recommends that the gap should be irradiated from a radioactive source (e.g. 0·2 to 0·6 mg radium) or from an ultra-violet lamp for applied voltages of 50 kVp or less, and for all gaps between spheres of 12·5 cm or less diameter.

Sphere gaps longer than 2 to 5 mm gave consistent breakdown voltages either with or without the irradiation from 0·5 mg radium, but the radium caused a decrease of 0·4 per cent in the direct voltages. The voltage reduction was greatest for the smallest spheres, and the effect increased with gap length until it reached a maximum at a critical gap length which depended on the size of the spheres. Thereafter the irradiation caused less reduction of the voltage as the gaps were further increased. The effects are shown in Fig. 1.

The irradiation would cause an ion current which increased with gap length, and the resulting field distortion due to the space charge effect could account for the lower-

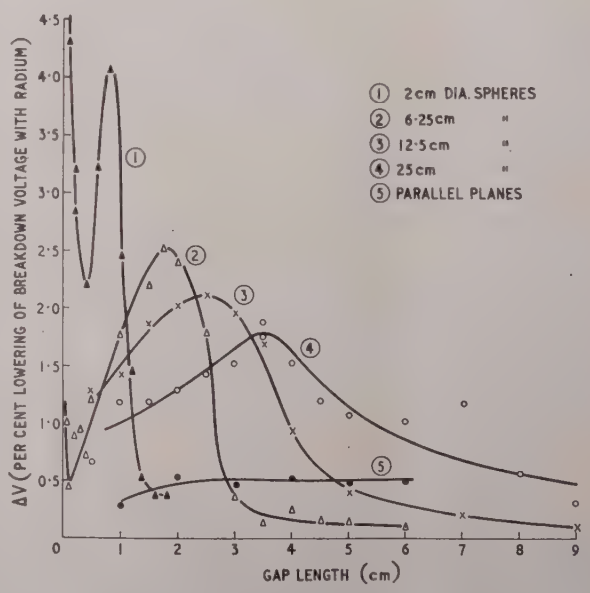


Fig. 1.—The effects of gap irradiation on the direct voltage breakdown of sphere-gaps

*"The Effect of Irradiation on the Breakdown Voltage of Sphere-Gaps in Air under Direct and Alternating Voltages." By E. Kuffel.
"The Influence of Humidity on the Breakdown Voltage of Sphere-Gaps and Uniform Field Gaps." By E. Kuffel.
"The Influence of Nearby Earthed Objects and the Polarity of the Voltage on the Direct Voltage Breakdown of Horizontal Sphere-Gaps." By E. Kuffel and A. S. Husbands.
"The Direct Voltage Calibration of Air-Gaps between Spheres up to 25 cm in Diameter with Recommendations for Standard Test Conditions." By E. Kuffel.

ing of the breakdown voltage as the gap was increased up to the critical value. The distribution of field strength along the axes of the critical gaps was analysed and the field strengths at the gap centres were approximately constant at 26-27 kV/cm in each case (Table 1a). It was unlikely that electron avalanches would propagate along the full length of a gap greater than the critical gap. However, the space charge distortion effects would be expected to increase with these longer gaps and so cause further reductions of the breakdown voltage with irradiation, but evidently the effect became masked by some other effect. The results indicate a change in the breakdown mechanism as the gap was increased above the critical gap length.

The experiments demonstrated that irradiation was necessary to obtain consistent results for very short gaps, but that it could cause changes of 0-4 per cent in the direct breakdown voltages of longer gaps. Its influence should be standardised in order to improve the accuracy of the sphere-gap calibrations.

Air Humidity

The influence of the humidity of the air on the direct breakdown voltages for different sphere-gaps is shown in Fig. 2, which demonstrates that a change from dry to quite humid air causes an increase of up to 4 per cent in the breakdown voltages. In some respects the humidity has an inverse effect to that of irradiation. Thus the humidity increases the voltage, and the greatest humidity effect occurs with the largest spheres. In common with the irradiation results, the humidity has a maximum effect with a critical gap length for a given size of spheres, although the critical gaps were slightly shorter under the humid conditions.

Water vapour has a greater tendency than air to capture free electrons by a process of attachment which forms negative ions. The latter make no contribution to the gap breakdown mechanism. Thus the attachment process tends to counteract the formation of new electrons by the process of ionisation by collision, so that the total ionisation is reduced for a given field strength. Consequently the field strength (and hence the applied voltage) must be increased to achieve the critical conditions for the initiation of a breakdown in humid air.

Table 1.—Variation of the field strengths along the axes of the gaps which gave the maximum irradiation or humidity effects

(a) *Irradiation Effect.* 0·5 mg radium, water vapour pressure = 4 mm Hg.

Sphere diameter cm	E_{max} kV/cm	E_{min} kV/cm
2·0	41·0	27·2
6·25	34·4	26·2
12·5	31·8	26·1
25·0	30·0	26·1

(b) *Humidity Effect.* No additional irradiation, water vapour pressure = 12·5 mm Hg.

Sphere diameter cm	E_{max} kV/cm	E_{min} kV/cm
2·0	36·4	28·6
6·25	34·9	28·7
12·5	33·6	28·3
25·0	30·6	28·6

Total pressure = 760 mm Hg.

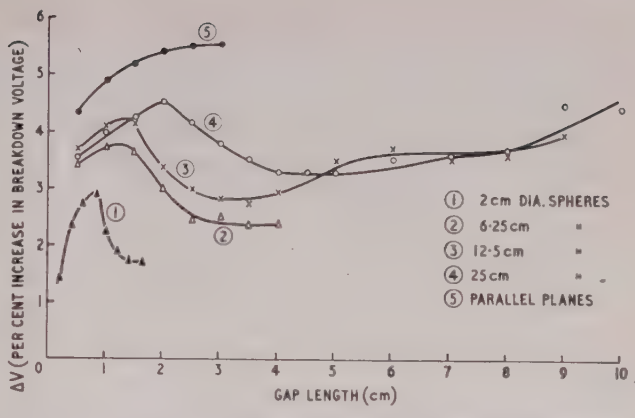


Fig. 2.—Increase in breakdown voltage for different gap lengths when humidity was changed from 0 to 17 mm Hg

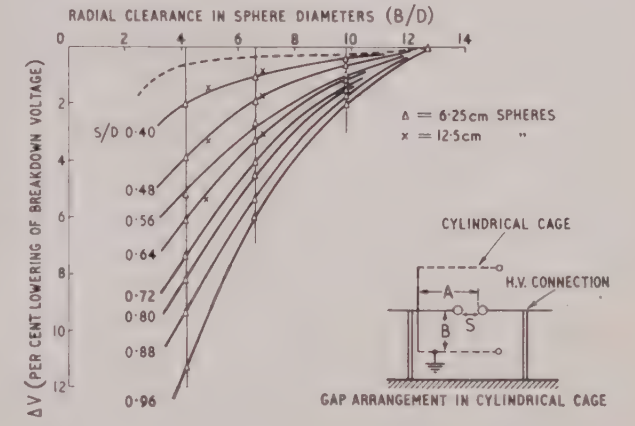


Fig. 3.—Change in breakdown voltage of 6·25 and 12·5 cm diameter sphere-gaps with radial clearance

An analysis of the field strengths in the critical gaps which give the maximum effects of humidity is given in Table 1b. The minimum field strength in each case was approximately constant at 28-29 kV/cm, when the water vapour pressure in the air was 12·5 mm Hg.

Between the humidity limits of 4-17 mm Hg of water vapour pressure the breakdown voltages increased approximately linearly with humidity. Variations of humidity in practice may cause variations of 1 to 3 per cent in the measured breakdown voltages for spheres up to 25 cm diameter, and possibly the variations would be slightly greater with spheres of larger diameters. The results were similar for both direct and alternating applied voltages. Experimental curves, such as those of Fig. 2, could be used to correct the measured voltages to a standard humidity condition and so eliminate most of the errors which are introduced by neglecting the humidity.

Proximity of Other Objects

Earthed objects in the vicinity of a sphere-gap tend to reduce the breakdown voltage because of the resulting distortion of the electric field between the spheres. The influence of a surrounding earthed cylinder is shown in Fig. 3, which demonstrates, as an example, that a change of 4 per cent in the breakdown voltage would result if the radial clearance (B) was reduced from, say, 12D to 5D for

a gap (S) of S=0·5D, where D=the sphere diameter. (The clearance of 5D is the minimum specified for 25 cm diameter spheres in B.S. 358, but with the added presence of an earthed plane.) An earthed plane parallel to the axis of the gap and distance (A) from the axis gave similar characteristics to those of Fig. 3 for comparable clearances.

When both the plane and the cylinder were present, and when the influence of one predominated, then the variations of the clearances to the other caused a negligible change in the breakdown voltages. An earthed plane can be a consistent feature of any practical arrangement of the test equipment, and its influence could be made to predominate by specifying a comparatively short clearance A. Then the minimum radial clearance B could be the least radius of a surrounding cylinder which had little additional effect on the breakdown voltages. A standard clearance to an earthed plane of A=4D is suggested from a consideration of the results, and this clearance could be the same for all sizes of spheres. It should be closely maintained during the calibrations of sphere-gaps. The present standards permit variations of the clearance A during calibrations and they call for larger clearances, in terms of D, for the smaller spheres. Both features seem undesirable since they may introduce inconsistencies between the calibrations of different laboratories, and between the calibrations for different sphere sizes. However, such variations could be permitted when the calibrated sphere-gaps are used subsequently for voltage measurement purposes.

Small Influences

The polarity of the direct voltage had an influence of about 0·5 per cent or less for sphere-gaps up to S=0·75D between spheres up to 25 cm diameter. The condition of a positive high-voltage sphere tended to give the higher breakdown voltages, but the effect was small enough to ignore for most practical purposes.

Copper or aluminium spheres gave similar results within 0·5 per cent, with a tendency for the aluminium to give the slightly lower breakdown voltages. Electrodes roughened by many sparks gave a greater dispersion of the voltages.

There was a small electrode conditioning effect, and when a small enclosing chamber was used there was a small air conditioning effect. The joint influence of these effects was 1 per cent or less and the breakdown voltages stabilised after the first few breakdowns.

Calibrations of Sphere-Gaps

Breakdowns of a sphere-gap under direct or alternating voltages could be repeated with a better consistency than the ±5 or 3 per cent quoted in the present specifications for the use of sphere-gaps. The improved consistency requires a close control of the influences of irradiation, humidity and the clearances to nearby objects, each of which may cause random variations of several per cent of the voltage as they are specified at present. In particular, an improved consistency and accuracy is desirable when calibrating the sphere-gaps. It is suggested that the test conditions for this purpose should be specified separately from the corresponding conditions which may be recommended when a calibrated sphere-gap is used subsequently for the measurement of voltages. In the latter case the test conditions could be similar to the calibration conditions, or they could be relaxed by extending the permitted limits of variation when the best measurement accuracies are not required.

CONSULTING ENGINEERS' DINNER

LAST week, the Association of Consulting Engineers held its annual dinner at the Dorchester Hotel, London. When Viscount Hailsham proposed the toast of the Association he stressed the commercial importance of the engineering profession in the modern world. The work of the consulting engineer was perhaps the most interesting as well as being the most relevant to the contemporary situation. All professional engineers must keep in touch with the latest developments in a technology which was rapidly changing. It was necessary to have a continuing relationship with research and education and also some means of keeping the results of research and education in front of existing practitioners.

The response was made by Mr. Charles Blackburn, chairman of the Association, who said that when the consulting engineer went abroad there was no doubt whatever that he could carry with him the full backing of scientific research effort in this country, and that it would be made very freely available to him, but perhaps we had not thought sufficiently about making it evident to the foreigner that this scientific information was fully available to the consulting engineer and that he was recognised as a suitable agent for its dissemination and application in circumstances abroad. Mr. Blackburn agreed with Viscount Hailsham that this should not be a one-way traffic. He felt that consulting engineers could contribute something here by indicating to the research establishments lines of research valuable in export markets which did not quite correspond with circumstances at home.

Mr. Angus Paton, past-chairman of the Association, then proposed a toast to the guests and Lord Hurcomb replied briefly, saying that the value of the world-wide availability of our engineering consultants was greater to our national economy than it was ever before now that so many sources of invisible export seemed to have dried up.

North of Scotland Board's Report

THE annual report of the North of Scotland Hydro-Electric Board for the year ending 31st December, 1960, published last week (H.M. Stationery Office, price 5s), reveals that the year's operations produced a credit balance of £222,595. The hydro-electric power capacity increased to 875 MW and 8,960 new consumers were connected during the year. The main construction work was centred on the Beauly and its tributary the Farrar, and on the River Awe. In October, the constructional scheme for the Nevis project was published and a start was made on the preparation of a construction scheme to raise the level of Loch Laidon. A detailed summary of the report will be published in next week's issue.

VIEWS on the NEWS

By "REFLECTOR"

WHEN Electricity Boards raise their prices they invariably explain that the increase will mean only a small extra payment by the average consumer—generally a few pence a week. I doubt whether they are wise to commit themselves in this way. Every time they issue such a statement a flood of letters to the local newspapers follows. For instance, the South Western Board has announced a forthcoming increase in charges which, it says, will amount to 8½d a week for the average family. People have immediately written to the Press to show how much more than this they will have to pay. Naturally, those whose increase is 8½d a week or less do not send letters about it. Apparently in this particular case the statement was based on an average annual consumption of 2,000 kWh; very many people use more than this but still consider themselves to be "average."

* * *

Children are apt to endanger themselves by playing about with plugs and sockets. Shuttered sockets prevent them from putting their fingers in the holes but they can still insert the plugs. A colleague tells me that at the Cologne Hardware Fair last week he saw a strange German device for preventing this. It is a *Steckertresor*, or "plug safe," a tumbler-shaped thick plastic container with a lockable lid in which the plug is placed. The makers say that, among other things, it prevents children from using the television set in the absence of their parents, but they also suggest that it may be useful to stop unauthorised adults from connecting up machines and appliances. Whether the *Steckertresor* is absolutely unbreakable is not known.

* * *

Seven miles of 132 kV cable is to be laid between Kingston and Chessington, Surrey, and this is likely to affect many people on the route. So the local office of the Central Electricity Generating Board decided to do a little public relations work to retain the goodwill of about 1,000 householders. For this they selected a foreman cleaner, Mr. J. Finlay, who seems to be doing the job very well; he says that he finds the people very friendly and understanding. Mr. Finlay seems to have a way with him.

* * *

Trams and trolley-buses are being abandoned by public transport authorities, a movement which has naturally been deplored by many electrical people—apart from those responsible for building and supplying the vehicles. It seems as though the electric traction balance may be redressed to some extent in some areas—Glasgow for instance. The local *Evening Times* reports remarks made by the city transport general manager, Mr. E. R. L. Fitzpayne, upon the decline in the number of passengers carried by the trams and buses. Apart from the adverse effects of motor cars and television upon the system, Mr. Fitzpayne expresses fears on the score of the Glasgow suburban railway electrification. The report says:—

> "The first electrified route, Helensburgh to Airdrie, would not have much material effect, but there could be little doubt that similar developments on the city and suburban lines must attract many bus passengers to what has been described as a 'tram service on the railways.'"

* * *

I see that the Consumer Advisory Council is asking members of the public for details of any electrical installation work which they have had done recently with particulars of the cost. This information is being collected on behalf of the Registrar of the Restrictive Practices Court in connection with the reference to the Court of the National Federated Electrical Association's agreement relating to the "margins" added to the cost of installation work. Those thus approached are not told to confine their answers to work carried out by "private" contractors, and so the Consumer Advisory Council (and presumably the Court) should obtain some useful comparisons between the prices and practices of Electricity Boards and those of private contractors.

* * *

Seventy years ago some experiments in photo-telegraphy were described in a paper read before the Royal Society by Mr. Shelford Bidwell. According to a report in the *Electrical Review* of 1st March, 1881:—

> "The author was led to the idea from experiments which he had made on the photophone. The principle of the arrangement is that of the Bakewell or D'Arlincourt copying telegraph, in which the variations of the current necessary to produce the design are effected by the action of light on a selenium cell. In the copying telegraphs referred to, the design is traced out in a series of broken lines of uniform thickness; in Mr. Bidwell's arrangement the varying force of a current produces a corresponding variation in the definition of the lines on the chemically prepared paper, and thereby a more faithful representation of the object copied is produced. The experiments made as yet have been only comparatively rough ones, yet the amount of success obtained was considerable, and would seem to prove that with more perfect apparatus very satisfactory results could be attained."

500 MW Sets for West Burton

Orders to a total value of £34 million are to be placed for four 3,450 klb/hr controlled circulation reheat boilers and four single-shaft 500 MW turbo-generators. The three-cylinder turbines will have initial steam conditions of 2,300 p.s.i. and 1,050°F with a reheat to 1,050°F

THE Central Electricity Generating Board has indicated its intention to place orders for turbo-generator and boiler plant for the 2,000 MW power station to be built at West Burton, Notts., about two miles south of Gainsborough. The boiler plant, valued at approximately £19 million, will be supplied by International Combustion, Ltd., and Simon-Carves, Ltd. The English Electric Co., Ltd., will supply the four 500 MW turbo-generator units, the total value of the contract being about £15 million.

The first turbo-generator/boiler unit is designed to be commissioned by June, 1965, and the whole station should be in full operation by the end of 1967.

Boiler

The design of the reheat boiler unit for West Burton is a natural development of that adopted for the 550 MW International Combustion unit for Thorpe Marsh power station ordered in 1959. The units which are of the controlled circulation type, will be skin cased and arranged for cubic expansion down to the economiser outlet. Each is arranged as a single sub-divided furnace employing tangential firing of the fuel from six p.f. mill units of the pressure type. Five mills will be capable of carrying the full load of the boiler. The fuels used at this station will be drawn from the East Midlands Division and the North Eastern Division of the National Coal Board.

Each of the four boilers will have a maximum continuous evaporative capacity of 3,450 klb/hr, the steam pressure and temperature at the superheater outlet being 2,400 p.s.i. and 1,055°F, and the reheat steam temperature at the outlet will be 1,055°F.

Last October, International Combustion and Simon-Carves announced that they had decided on a measure of integration and closer association of their two organisations. This would be applied especially in the technical fields and the responsibilities for carrying out the West Burton contract have been mutually agreed by these two companies. The technical facilities of each organisation best suited to each section of the contract will be used.

Turbines

Each of the four 500 MW units will comprise a three-cylinder 3,000 r.p.m. turbine with multi-exhausts arranged as a tandem compound unit coupled to a hydrogen/water cooled alternator of the direct cooled type. Solid couplings will be employed between each rotor and each shaft will be mounted on two main bearings. The steam conditions at the turbine stop valve will be 2,300 p.s.i. at 1,050°F with reheat to 1,050°F. The vacuum at maximum and continuous rating will be 28·7in Hg.

The high-pressure cylinder will employ a double casing arrangement over the first stages with the expanded steam passing over the outside of the inner casing to pass through the remaining stages. The intermediate cylinder will have a partial double-casing construction at its steam inlet while the multi-flow low-pressure cylinder will have a double-flow arrangement. To allow for differential expansion, the nozzle plates and diaphragms will be mounted in separate inner casings.

Generator

Due to transport limitations, the weight of the heaviest component of the generator, namely the inner stator, must not exceed 200 tons. Thus the generator for this single shaft set will be designed with three main components, the rotor, and the inner and outer stators, instead of the usual two.

The 3,000 r.p.m. alternator will generate at 22 kV. It is designed for a short-circuit ratio of 0·4 and a power factor of 0·85 lagging. The rotor will be machined from a single forging, the inner stator frame will carry the core and windings while the outer stator casing, which will be a welded steel cylinder, will carry the inner stator and the hydrogen coolers. The direct cooling system will employ hydrogen at a pressure of 60 p.s.i. for the hollow rotor conductors and for the stator core, and water for the hollow stator conductors.

The hydrogen will be circulated by a multi-stage axial-flow blower mounted on the rotor shaft. The recooled gas will enter the conductors at each end of the rotor body to cool the slot and end windings separately. The stator core will be cooled by a separate stream of gas; all the hot gas flowing through the first stage cooler and thence to the blower intake. The blower will discharge through a diffuser to the second stage cooler, from which the fully cooled gas will re-enter the machine.

The water for cooling the stator coils will circulate in a closed circuit, make-up water being drawn from the demineralisation plant while the hydrogen coolers will be fed with condensate.

Excitation will be provided by a direct coupled exciter, the output of which will be converted by silicon rectifiers feeding directly into the sliprings of the main alternator rotor. The rotor current of the exciter alternator will be derived through rectifiers from a h.f. alternator coupled to the exciter. This current will be adjusted by a continuously acting automatic voltage regulator. This system offers important advantages over conventional d.c. exciters in that the large speed-reducing gear box is not needed and maintenance of the commutators and brush gear is eliminated.

Feed Heating

Seven bled steam stages will be employed for the feed heating system. The h.p. heaters will be arranged on the discharge side of the boiler feed pump. The main boiler feed pump will be driven by an auxiliary steam turbine of English Electric manufacture and this company is also supplying the condensers and other items of the feed heating system.

I.E.E. Annual Dinner

PROBLEMS OF A RAPIDLY EXPANDING INDUSTRY

THE annual dinner of the Institution of Electrical Engineers was held at Grosvenor House on 23rd February with the President, Sir Hamish MacLaren, in the chair; there was a record attendance of 1,495 members and guests. The Rt. Hon. Richard Wood, Minister of Power, who proposed the toast of the Institution, remarked that engineers aroused different feelings in the public mind at different times and in different circumstances. In rural areas, where electricity since the war had wrought the greatest change, electrical engineers seemed to many to be fairy godfathers, but to others they appeared with their power stations and grids as despoilers of the countryside.

Minister's Responsibilities

When he first went to the Ministry he wondered what should be the Minister's precise relationship to the electrical industry. It seemed to run very smoothly without him, and there were times when he suspected that the industry's smoothness of operation was in inverse ratio to the number of occasions on which the Minister tried to interfere. He was convinced, however, that in many fields close co-operation between the industry and the Minister could yield good results. One of these was the controversial one of price policy. It was not the Minister's responsibility to fix tariffs, but no Minister of Power could pretend that the structure and levels of tariffs were no concern of his. Within the framework of the competitive fuel policy which the Government believed to be right the Government must be responsible for seeing that competition between electricity and other power industries was on the basis of prices which properly reflected the relevant costs. What was even more important, the industry was a vast consumer of capital, now spending about £300 million a year, or one-sixth of the total public investment.

The rapid expansion of the industry brought with it many problems, but the central problem was not the physical transmission of energy from one place to another but the fact that this raised a whole host of important considerations, human, social, economic, æsthetic and so on. He was impressed by the fact that none of these considerations escaped the attention of electrical engineers. This breadth of view and clear-sightedness on their part gave him the greatest confidence in the future of the industry.

Revolution Every Ten Years

The President, who responded, said that electrical engineering was an art in the application of which a revolution seemed to take place every ten years. This could be measured quantitatively by the fact that the consumption of electricity in this country doubled in each decade and qualitatively by the progress made in the development and application of new devices, and particularly at present in electronics and in the constant improvements which resulted in higher efficiencies in the generation, application and control of power.

This meant that the Institution must be constantly and continuously adapting itself to the progress made. For the last two years or more it had been grappling with the problem of reshaping its specialised sections the better to discharge its obligations to its members and to the community which it served. He appealed for a bold and imaginative approach to this problem. The history of the Institution since its foundation in 1871 was one of constant change and progress, and in view of the breath-taking advances of recent years it was not surprising that some re-alignment in the organisation of the Institution should be found desirable. Proposals to this end had been approved by the Council last July and he looked forward to submitting in the near future the results of further deliberations to the Council.

While being concerned to deal with highly specialised aspects of electrical engineering they were aware of the need for more cohesion in the engineering profession generally. The work of engineers as a whole was probably less well understood here than in any other industrialised country. Science was surrounded by a glamour which attracted to the

Left: Sir Hamish MacLaren speaking at the I.E.E. annual dinner. Centre: The Rt. Hon. Richard Wood (Minister of Power) with the President and Councillor R. L. Everest (Mayor of Westminster). Right: The Hon. W. T. M. Beale (Minister for Economic Affairs, American Embassy) with Mr. S. E. Goodall on his left

ranks of scientists a stream of able young men, but in this country there was apt to be too great a time-lag in the practical application of the results of their researches, and this was not unconnected with the shortage of engineers.

" What more can we do," Sir Hamish asked, " to improve the status of the engineering profession and ensure that we attract our share of the best talents available ? Sir Willis Jackson referred to this last year and expressed the hope that means would be found to achieve closer co-operation between the leading engineering institutions. Like him, I do not think that amalgamation should be our goal. The field of electrical engineering is so wide that there will continue to be the need for an Institution devoted exclusively to it, but I would add that I consider all applications of electrical engineering so closely linked with one another that any attempt at fragmentation in our field must be strenuously resisted. There are, however, many aspects of our Institution's activities which could be more effectively handled if there was an organisation which could speak for engineering as a whole. This could take the form of an Institution supported by the existing Institutions or of a Joint Council of the Institutions concerned."

Sir Willis Jackson (left) welcoming Mr. Denzil Freeth, M.P. (Parliamentary Secretary, Office of the Minister for Science)

Much thought and discussion were being devoted to this matter, and nothing but good could come from making known as widely as possible that such discussions were taking place, so that the members of all the Institutions concerned could form and express their opinions on a subject of such far-reaching importance to them. " My own thinking on the subject," he added, " takes me so far as envisaging a sort of supra Institution of Engineers, membership of which would be conferred on all corporate members of the supporting institutions, analogous to the Bank of England, the bankers' bank, in the banking world; but I am aware that not all are prepared to go so far as this and we may have to begin more modestly."

There was a danger in a highly developed country such as this that the division of labour on which our standard of life depended and the intense pursuit of specialised branches of science would encourage too early specialisation in education, and this would prevent each individual developing his brains and personality to the utmost of which he was capable. " Have we not gone far enough," he asked, " in using modern production techniques to shorten the working week, and would not it be better to use our so-called affluence in time and money to extend the time available for preparing our future citizens for their work in life ? I do not suggest that we should aim at extending the normal school-leaving age beyond that necessary to ensure that no latent talent remains undiscovered, but we should aim at giving the 5 per cent or so of the coming generation who are endowed with the best brains a more liberal and leisurely approach to their work in life. It is on that small percentage that the future of our country mostly depends. We are failing to develop them to the potential of which they are capable by demanding too early specialisation. In present circumstances, a boy at a public or grammar school has to make an almost irrevocable decision about his future between the ages of 14 and 15, which is far too early."

There would be advantage in pre-university schooling providing a broad general education up to the age of 17, followed by one year of sixth form part-specialisation. The standard reached in the specialised subject might not be so high as at present, but this would be more than compensated for by the undergraduate having had a better and broader school education. Even if it meant spending an additional year at the university, the results would more than justify the additional time and effort. At one time it had been usual at the most northerly university in these islands for a young man to take an arts degree before reading science or medicine. The subsequent careers of those who did so in most cases fully justified the time and effort. It was to be regretted that in the unseemly haste of today there were very few who did this, and the professions concerned and the country were the poorer in consequence.

The toast of the guests was proposed by Sir Willis Jackson, and the Hon. W. T. M. Beale, Minister for Economic Affairs, American Embassy, responded. He said that some of his regrettably limited knowledge of the British electrical industry had been developed during a recent tour of duty in Washington, when on several occasions he had been approached by British diplomatic representatives who wanted to be sure that British electrical equipment would be used in the construction of certain dams in the United States.

He then dealt with the economic situation in the United States and with the measures which the new administration was taking to deal with it. The next few years, he said, would see a determined effort to expand American exports and to persuade more tourists to visit the United States. Steps would be taken to stop tax and customs loopholes and to discourage undue spending of private dollars abroad. While America might be able to solve her problems temporarily by unilateral action, it was not intended to follow that course, but to adopt measures which would be of benefit to all and to realise her objectives through co-operative means.

Flow Measurement History

A series of articles under the general title of " The History of Flow Measurement by Differential Pressure " has been reprinted in book form and published by George Kent, Ltd., Luton, Bedfordshire, price 10s. This well-produced and extensively illustrated book covers several aspects of the subject in seven parts, describing the work of Giovanni Battista Venturi and Clemens Herschel; the development of the Venturi meters and recorders; the commercial metering of air, gas and steam; diaphragm-operated instruments, including steam meters; and finally developments in differential producers for flow measurement. There are 11 appendices giving tables of symbols and constants, the theory of discharge through nozzles and orifices and a description of the various types of meter.

INDUSTRY AND THE HOUSE

Conservation of Coal

By AUSTEN ALBU, M.P., B.Sc., A.M.I.Mech.E., M.I.P.E.

ONE more round in the coal miners' battle for their industry was fought in the House of Commons last week on an Opposition motion to reduce the supplementary vote for the Ministry of Power by £1,000. This was not an occasion for an all-night sitting and some of the steam was taken out of the attack on the Minister by the fact that coal consumption is again exceeding production, but the miners are convinced that the Government is prepared to see their industry thrown to the wolves of competition, chiefly from oil, and brought a mass of statistics to their aid.

In fact the debate was opened not by a miner but by a newcomer to the fight, Mr. Ray Gunter, a railway clerk and an influential member of the Labour Party National Executive. The Welsh oratory he employed with such effect at the Labour Party conference was somewhat dampened by the mass of information which he had to give to the House, although he wound up with a passionate indictment that the Government were without vision and powers of leadership in everything that they touched. The main burden of his case was the prognostications of some experts that there would be a shortage of fossil fuels within the foreseeable future, before nuclear power was in a position to replace them. He drew the conclusion that it was our national duty to plan wisely the conservation of our most valuable asset—our coal reserves. The cost of bringing abandoned pits into use was tremendous, he said.

Sacrificing for the Future

He did not underestimate the difficulties because such a policy was not compatible with free competition. Long-term planning was needed which meant some present sacrifices for future benefit. The change which had shaken the confidence of the mining industry came in 1957 when inland consumption fell by five million tons and exports by two million tons. In the three years 1957-59 there was a total fall in coal demand of 33 million tons or 15 per cent. This had led to a fall in manpower of nearly 130,000 men by the end of 1960. There was reason for satisfaction in 1960 when inland consumption rose by 4 per cent, but industrial production rose by nearly 30 per cent and fuel oil imports by about 35 per cent.

Mr. Gunter admitted that we could not ruthlessly reduce oil imports or consumption. What was required, he said, was a careful analysis of the choice between allowing the importation of oil heedlessly so that it caused irreparable damage to a national asset or the planning of imports to keep that asset intact. He suggested that the Minister should set a minimum figure for coal production for some years ahead, to be kept under constant review. In the immediate future oil-fired generating stations should be converted to coal, any compensation to the oil companies to be met by the Minister. Open-cast working should be reduced to the greatest practicable extent. Taxation should be imposed on heavy fuel oil as had been done in Western Germany. Attention should be given by the Government to exports and higher priority should be afforded to scientific research in the fuel industries. In particular there should be co-ordination of work on new methods of coal gasification.

Demand Exceeds Output

The Minister of Power refused to accept the basis of the Opposition's case. He said that the proportion of proved reserves of oil to world consumption had been continually rising and behind these reserves lay vast quantities still to be discovered. He denied the need for the measures Mr. Gunter had proposed because coal demand at present was running at a considerably higher rate than coal production. He was convinced that fuel policy must lie between the two extremes of fixing a target for coal and restricting the consumption of other fuels and pursuing a policy at the opposite extreme of unfettered competition. He rejected the path of protection, but was convinced that completely free competition must be supplemented by measures which would take into account considerations which the market was liable to ignore.

During 1960 6½ million tons had been lifted from stock and stocks were now being disposed of at the rate of over two million tons a month. The National Coal Board estimated that there would again be a considerable gap between production and demand in 1961 and therefore a further considerable stock-lift was likely. On the question of manpower, the Minister said that the Board resumed general recruitment in 1960 when there was a substantial improvement in demand; losses in manpower continued for the rest of 1960 but fell to 350 a week. Since the end of 1960 the position had been comparatively stable.

The capital investment of the Board, which was planned for 1960-61, looked like being at least £20 million lower than the approved figure of £120 million. The Board's total capital requirements would also be reduced by changes in working capital which depended on the level of stocks. Contrary to the view he had expressed in January, 1960, that the limit on the borrowing power of the Board of £50 million, which had been accepted in response to back bench pressure, would be exceeded in the fiscal year 1960-61, borrowings had in fact turned out to be £20 million. On revenue account, while the Board had made a profit of £3 million in the first quarter of 1960, in the second quarter it incurred a loss of £10 million and it was inevitable that the third quarter should also show a substantial loss. This was a matter of concern to the Government and the Board and they were examining the position further.

The debate followed the usual pattern, slightly enlivened by Col. Lancaster, an ex-coalowner himself, who misplaced a decimal point. He claimed that the National Coal Board had a staff of over 4,000 at Hobart House and said this meant 3s 6d on every ton of coal. That solid Durham

miner, Mr. Blyton, who wound up for the Opposition, was able to put him right. He said that the facts were that at Hobart House there was a staff of 1,890 and it cost 2d a ton. On the register at Hobart House were included people at research stations bringing the total figure to 3,400 or 4d a ton.

The Parliamentary Secretary, Mr. George, replying to the suggestion that we should stop using oil in power stations because there was no cost advantage, said that the relative cost of coal and oil depended on the situation of particular stations. On the Thames estuary and the south coast it was 30 per cent more expensive to generate from coal than oil and at large modern stations, such as Marchwood, it would cost about £2 million a year more to operate on coal than oil at the present time. The trend of load increase was now about 6·9 per cent per annum and the Central Electricity Generating Board had produced a remarkable performance in that 93 per cent of its equipment was ready to go into use or was in use at the end of the year. That had never been done before in the industry and the extra demand had resulted in 5·5 million tons of additional coal being used by the Central Electricity Generating Board in 1960. It had been expected that the amount of oil used in dual-fired stations would fall to three million tons in 1965, but that was unlikely to take place now. The plants now in use must be maintained to meet the additional load and the Board might be hard pressed to keep hold of the situation next winter and in succeeding winters.

In an answer to a question about the cost of electricity generated at the most modern coal-fired power stations and the expected cost at the nuclear power station to be built at Wylfa the Minister gave a somewhat enigmatic answer. He said that, depending on the distance from the coalfields of power stations, the cost of conventional generation seemed likely to be between 0·5d and 0·6d per kWh. It was too early to give a figure for Wylfa, but the cost was not expected to be above this range. This did not mean that the break-even point between conventional and nuclear power generation was being reached because the capital cost of nuclear stations was very much higher. That point would not be reached for some time.

ELECTRICITY IN SOUTHERN RHODESIA

FROM A CORRESPONDENT

THE annual report of the Southern Rhodesia Electricity Supply Commission for the year ended 30th June, 1960, has just been published. It shows that electricity sales increased by 6·43 per cent, indicating that the country as a whole has not yet moved out of the depression, or recession, through which it has been passing. Total sales to mining consumers, at 321·8 million kWh, were only 1·03 per cent more than in 1958-59 and sales to gold mines decreased by 9·83 per cent. Supplies to asbestos and chrome mines were up by 1·18 and 2·97 per cent respectively. When these very low increases are considered in the light of the substantial investment in supplies to this class of consumer, the difficulties of an electricity supplier to primary producers can better be appreciated.

The year's trading resulted in a further loss of £500,006, and the accumulated deficit has now reached £1,535,199. This loss emphasises the need for higher charges and reference is made to the renewed application to the Electricity Council for a revision of tariffs. The publication of the Federal Power Board's tariff for future bulk supplies from Kariba, with the shift of emphasis to fixed costs, produced conditions which made a complete review of tariff structures and magnitudes necessary. The Commission engaged Messrs. Kennedy & Donkin to consider this question, and their report formed the basis of an application for revised tariffs which was finally approved by the Minister of Power last October. It is hoped that the implementation of these revised tariffs will convert deficits to a small surplus and gradually reduce the accumulated deficit.

The Federal Power Board's tariff contains a fixed basic component of 533 million kWh and 99·4 MW at 0·71d/kWh with a follow-on charge of £7 per kW plus 0·1d/kWh. With the high overall load factor of the Commission's load, over 60 per cent, the "cost of power" component should tend to drop considerably in future. The actual arrangement of the Federal Power Board, assuming costs of production of thermal plants interconnected with Kariba, is not unlike that adopted in the United Kingdom under the old 1926 Electricity (Supply) Act.

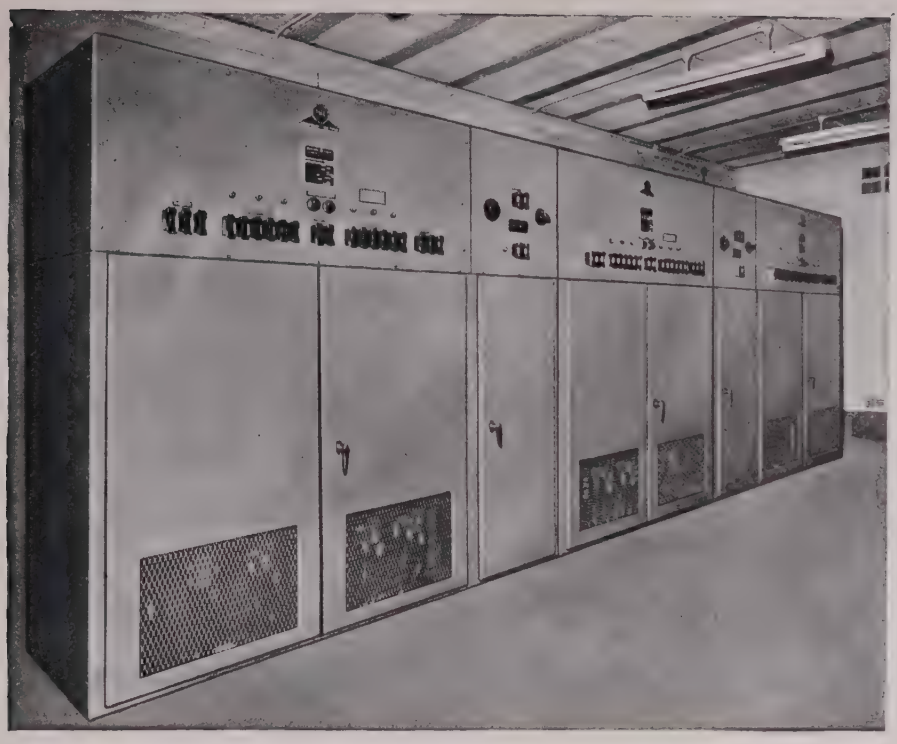
Of the individual classes of consumer, farms maintained the highest rate of increase with 14·55 per cent, and the average annual consumption is now nearly 20,000 kWh per annum. The actual number of new farms connected during the year was 77, bringing the total number connected to 2,745.

During the year a net 190 miles of line was added to the transmission and distribution systems, bringing the total route miles at all voltages to 7,804. With consumers connected at around 7,200, this ratio of miles of line per consumer must be a world record. On 14th May, 1960, the Umniati generating station was paralleled with Kariba and import commenced on a limited basis.

The new capital expenditure during the year amounted to £829,298, which brought the total capital expenditure as at 30th June, 1960, to £24,656,121.

Interesting reference is made to the African staff and a system of long-service medals has now been introduced. Bronze medals are issued for 15 years and silver gilt for 25 years. Viewed in the light of the fact that the Commission has been in existence for only 24 years, the fact that 100 Africans had served for 15 years or more at June, 1960, speaks well for their service. European staff increased by 10 to 528 during 1959-60 and African staff by 17 to 1,787.

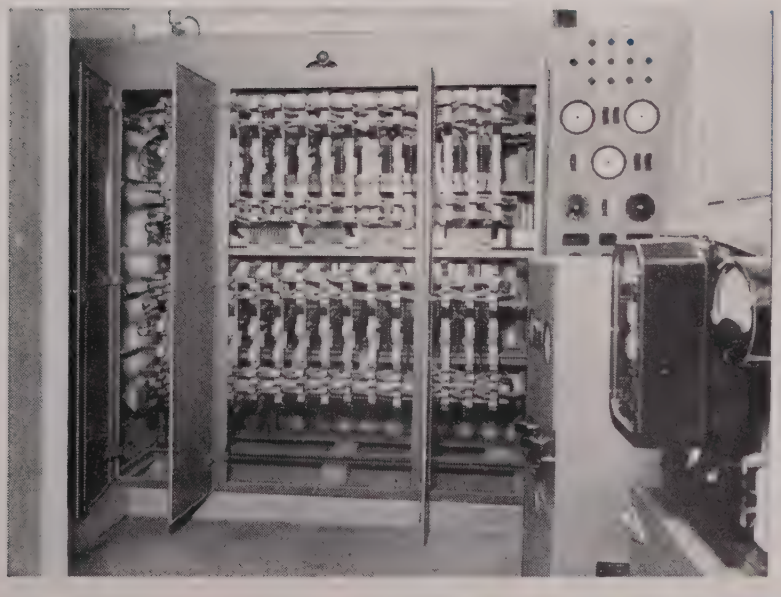
The retirement on 15th October, 1960, of Mr. A. B. Cowen, O.B.E., chairman and chief engineer for over 20 years, marked the end of an epoch, and appreciation of Mr. Cowen's services is recorded in the report.



A 1300 kW bank of Hewittic Germanium Rectifiers installed in the Shipyard of Messrs. Cammell Laird & Co. (S & E) Ltd., Birkenhead, for providing D.C. for shore to ship supply.

Germanium

rectifiers



A 6000 amp Hewittic Water-cooled Germanium rectifier providing a continuous output at 100 volts D.C. for an electrochemical process at the Luton works of Laporte Industries Ltd.

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RECORD NUMBER OF DOMESTIC ELECTRICAL APPLIANCES ON VIEW

COLOGNE SPRING FAIR

EVERY year the number of domestic electrical appliances shown at the International Household Goods and Hardware Fair at Cologne has grown and at this year's Spring Fair, which ended last Monday (27th February), the proportion of exhibitors displaying electrical household goods was the largest ever. More than 1,650 firms, from seventeen different countries, participated and the actual display area was approximately 24 acres—more than twice the size of the first Fair in 1954.

Apart from German firms, by far the largest foreign contingent was from France, with a total of 153 exhibitors. Great Britain was represented by 33 firms—a good representation—but in view of the unique opportunity which Cologne offers for making contacts and meeting buyers on an international scale, apart from inspecting the market, it is felt that more could perhaps have taken space.

The largest British stand was that organised jointly by the B.E.A.M.A. and the Board of Trade. Nine companies formed a collective exhibit and together they presented the largest display of British domestic electrical apparatus yet staged in Europe. Before the opening of the Fair on Friday last week, Mr. S. F. Steward (director of the B.E.A.M.A.) addressed a party of distinguished guests, who included Mr. J. A. M. Marjoribanks, Minister (Economic) at the British Embassy, Bonn, the Lord Mayor of Cologne and British and foreign Press representatives. He said that there was a growing spirit of co-operation between electrical manufacturers throughout Western Europe over a wide range of technical and commercial matters.

On the B.E.A.M.A. stand before the opening of the Fair. Left to right: Mr. C. G. E. Parrott (Export Department, B.E.A.M.A.), Mr. J. A. M. Marjoribanks, the Lord Mayor of Cologne and Mr. S. F. Steward

The electrical and mechanical engineering industries of the thirteen countries of Western Europe, he said, had been brought together and were working closely and effectively through ORGALIME (Organisme de Liaison des Industries Métalliques Européenes) in which there were now no barriers between the "Six" and the "Seven." Mr. Steward believed that by this kind of co-operation and by continuing improvement in manufacturing efficiency much could be done to alleviate the effects of the tariff changes resulting from the operation of the Common Market. West Germany was Britain's best single customer for small washing machines, and was among the ten best customers for electrical products of all kinds. At the same time West Germany supplied about one-fifth of the electrical goods imported into Britain. This, said Mr. Steward, confirmed that the industries of each country were in many ways complementary. It was because of the Association's conviction that this interchange of trade would continue and expand that the B.E.A.M.A. was marking its 50th anniversary with the jubilee display at Cologne.

The B.E.A.M.A. stand, this year in an excellent position near the entrance to Hall 2 and with access from all sides, was well attended during the period of the exhibition, and buyers from all over the world were able to examine and assess the diversity of goods on display. The chief item of interest among the Simplex products was undoubtedly

The German television camera team filming the "Creda Constellation" cooker on the Simplex "Creda" stand

the new "Creda Constellation," a large luxury type automatic electric cooker with two ovens (one with a rotary spit), two warming drawers, two grills and an extra large hob with four plates. . During a preview of the exhibition the cooker was noticed by the German television planners and the result was that it was featured in a television programme dealing with the Fair. So far as can be ascertained, it was the only British product to be seen by television viewers. Simplex also displayed, for the first time, the "Creda" firelighter. This appliance, mounted on an adjustable wire stand, has an enclosed heating spiral (635 W) and a 15 W fan motor and operates on the principle of a hair dryer.

The English Electric Co. was well pleased with the impact that its new model 2034 double-oven cooker had made and great interest was also shown in the company's "Liberator" automatic washing machine and "Tumbledry" clothes dryer. The company also displayed its "Slimline" range of refrigerators, including the latest 4·1 cu ft model.

A number of interesting inquiries were received by the General Electric Co., Ltd., and the opinion of a spokesman on the stand was that "it was certainly worth while coming." A selection from the G.E.C.'s wide range of products displayed included a "Genalex" cooker with two, three and four hotplates on a unique one-piece design hob; an electric firelighter with a loading of 1,800 W; warming plates; kettles; toasters, etc.

Such was the interest in Berry's Electric stand where the chief items were, of course, "Magicoal" imitation fuel-effect electric fires, that at times those in charge were unable to cope with the number of visitors. It was felt that there should have been more company representatives in attendance.

Radiation International, Ltd., on a well laid out stand, showed their "Jackson" 490 series cooker, which included an eye-level grill, automatic oven control and "Speedring" plates. Also to be seen was the Parnall "Spinwasher," a single-tub semi-automatic washing machine; the "Auto-Dry" tumbler dryer; and, to complete the home laundry exhibits, the "Ezy-Press" ironer.

Heatrae, Ltd., was well satisfied at the results of showing its water heaters. This company was exhibiting at Cologne for the first time and the emphasis was on the "Lido Express" water heater and three versions of this appliance were on display. Also shown was the "Lidomat"—the under-the-sink version of this heater—offered with alternative sets of taps which give eight different hot water systems. Heatrae were also able to sound the German market with their "Speedy Twin" 6 kW storage heater, as well as electric fires.

On the Dimplex stand the company's oil-filled towel rails created a great deal of interest. Many Continental visitors were seeing such an appliance for the first time. The Dimplex range of infra-red heaters, also displayed, certainly compared favourably with many of the Continental models shown elsewhere at the Fair—both in design and price. Here again the verdict was that participation at this particular Fair was money well spent.

Bearing in mind that the Fair consisted of ten interlinked halls, it was not surprising that nearly 400 different stands had on view electrical household appliances ranging from a selection of small "gadgets" to food mixers, vacuum cleaners, dish washers, washing machines and refrigerators. As a result of the steady rise in the standard of living in West Germany in recent years, it is estimated that the total expenditure of a typical four-five person household on electrical appliances has risen from $4\frac{1}{2}$ per cent in 1950 to 8·3 per cent in 1958, and the figure for 1960 is expected to be above 9 per cent.

The German Appliance Market

Electric cookers were displayed on as many as 70 stands and these represented the products of 31 different manufacturers. All the German electric cooker manufacturers who had stands at the Fair made, in addition, both gas- and coal-burning cookers. The production of gas cookers in Germany declined from 504,000 in 1959 to 443,000 last year, although this still represents a high level. The trend towards cooker "automation" continues and improvements have been made to the grill attachments. So far as can be ascertained there are now approximately five million electric cookers in use in Germany, but of these only 50 per cent incorporate automatic features. Most Continental home cooking is carried out on the hob—the oven is chiefly used for baking cakes—and a noticeable feature of the electric cookers on display, chiefly French types, was the fold-down table-top lid that completely covers the hob.

German refrigerator manufacturers are, on the whole, satisfied with last year's sales. Exact figures are not available, but last year they produced 400,000 refrigerators more than in the previous year and estimated their total production at 2·2 million. There is now a growing interest in domestic refrigerators in Germany and the rise in living standards has resulted in the housewife buying the larger luxury type of refrigerator. Frozen foods are becoming more popular and the demand for refrigerators incorporating deep-freeze compartments has correspondingly increased. Italy was by far the largest supplier of refrigerators to Germany last year, whereas Germany exported more refrigerators to Great Britain than did any other country. The refrigerators shown at the Fair did

not reveal any noticeable trends that are not already incorporated in British models. Most models on display were in the 5 to 7 cu ft capacity range.

At present there are about 50 different makers of washing machines in Germany and of this number about 15 firms between them account for approximately 80 per cent of the entire market. The washing machine with the hand or powered wringer is now almost extinct and the agitator type is also rapidly on its way out. Most of the models displayed operate on the revolving drum principle—the washing is loaded into a perforated drum which either oscillates or revolves. The drum also serves as a spin dryer after the water has been drained.

Whereas in this country there are only about six companies which offer a domestic dish washer, in Germany there are approximately 30 different makes on sale, including imported machines. The cheapest machine costs approximately £25 and the most expensive about £175. Philips (of Hamburg) showed a new dish washer priced in the region of £150. The British-made "Colston" dish washer, shown by agents of the company, was noticed to be receiving a great deal of attention.

Vacuum cleaners, in one form or another, were very much in evidence. The majority of manufacturers displaying these all seemed to favour the upright or "stick type" cleaner (the "hallmark" of a Continental cleaner). None of the few cylinder types seen appeared to be in any way superior to the British models.

In addition to all these larger electrical appliances many practical innovations were noticeable among the vast number of portable machines. One of the food mixers shown had a flexible drive for operating additional attachments. We also noticed a wall-fixing hood-type hair dryer specially designed for domestic use.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

The Status of Engineers

THE leading article in your issue of 10th February has called attention to the recent salary survey carried out by the Engineers' Guild. Members of the Guild, whose voluntary subscriptions provide the sole source from which such undertakings can be financed, will be glad to see that your readers are being encouraged to think about these questions.

At the same time you were critical of some of the opinions on salary trends expressed in a leading article in the same issue of the *Professional Engineer*, and it should perhaps be emphasised that whether these opinions be right or wrong the results contained in the survey report are unquestionably authentic. By giving the world, as well as its own members, the detailed results the Guild has allowed everyone to draw his own conclusions from the facts. It is our intention that the collection and publication of this kind of information shall be kept up to date, because in any move to improve the standing of the engineering profession the starting point must be a properly documented statement of the present situation and trends of change. It is felt in the Guild that every qualified man should join in and share the burden of this work, because every qualified man will ultimately benefit, as will the whole technological structure of the country.

As for the opinions which you dispute, some of these were never expressed. For example, the general tenor of your article suggests that the Guild believes salaries have risen far enough because they are now about 32 per cent higher than they were four years ago (32 per cent is a more accurate indication of the general rise than is the figure of 25 per cent which you quoted), but in fact the comment referred to was nothing more than an examination of the factors that are likely to limit the future rate of increase. Nobody who troubles to read the Guild publications for himself, or who attends Guild meetings, will make the mistake of thinking that engineers, as represented by the Guild, will be content with anything less than a dramatic increase in the influence and responsibility of their profession, to accord with the increasingly dominant part played by technology in all material aspects of our civilisation.

Salary levels are recognised as both an index and a determining factor in the relation between society and the engineer. If engineers show themselves able to analyse and to comment objectively on their own incentives, they are likely to deserve and receive the increased respect for which they are aiming.

London, W.C.1. J. G. ORR,
Secretary, Engineers' Guild.

Women and Wiring

I HAVE read "Reflector's" comments in the *Electrical Review* of 10th February on the formation of a branch of the Electrical Association for Women in Wellington, New Zealand, and I suggest that in the report "Wiring of Plugs and Fuses" really means the connection of plugs and the renewal of fuses.

As one who has had extensive experience in the "Home Worker's Course," organised by the E.A.W., with the active support of the Area Boards, I can assure you that, with suitable instruction, a housewife can make a first-class job of connecting a three-core flex to a three-pin plug. In many cases the work is equal or even superior to that of many craftsmen.

Surely it is better for the housewife to know how to do this job properly and to be able to renew a fuse with the correct size of wire, rather than let her find out the "hard way," with unpleasant results in many cases.

In addition, instruction is given on the care and operation of appliances and calculation of running costs for space heating and water heating.

I do not think that "Reflector" has any need to worry that such instruction will lead to a desire on the part of the housewife to take up electrical installation work.

"HELIOS."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. L. J. Brown, F.C.A., and **Mr. Hector D. Walker,** M.I.Mech.E., have joined the board of Johnson & Phillips, Ltd. Mr. Brown is a director of Electric & Musical Industries, Ltd., and was for some years managing director. He is the resident director in the United Kingdom of the

Mr. L. J. Brown

Mr. H. D. Walker

Schlesinger Organisation. Mr. Walker is a director of Constructors John Brown, Ltd., and its subsidiaries, and other companies.

Sir Richard E. Yeabsley, C.B.E., J.P., has accepted an invitation to join the board of Bailey (Malta), Ltd. In view of this appointment and his other commitments, he will not offer himself for re-election as a director of Johnson & Phillips at the next annual general meeting.

Major F. D. Outridge, R.A. (Retd.), F.C.C.S., has been appointed assistant to Capt. R. A. Villiers, C.B.E., director of the Scientific Instrument Manufacturers' Association.

Mr. R. H. Rockliffe, A.M.I.E.E., is to become Birmingham and District Sub-Area engineer of the Midlands Electricity Board in succession to **Mr. A. C. MacQueen,** M.I.E.E., who will be retiring later this year. Mr. Rockliffe is at present manager of the Board's South West Birmingham District. He joined the Birmingham Corporation Electric Supply Department in 1946 as a graduate trainee and held progressive posts on the engineering staff of the Birmingham Sub-Area of the M.E.B. before being appointed deputy to the sub-area engineer, Mr. MacQueen, in 1955. In March last year he was appointed to his present position.

Mr. R. H. Rockliffe

Mr. R. L. Basset has been appointed a director of Associated Electrical Industries, Ltd., and has resigned from the board of A.E.I.'s Woolwich Group. Mr. Basset, who is 62, was educated at Eton and Sandhurst. He joined the board of Siemens Bros. & Co., Ltd., in 1952 and also became a director of Siemens Electric Lamps & Supplies, Ltd., Siemens Edison Swan, Ltd., and Alfred Graham & Co. Ltd.

Mr. R. H. Phillips, managing director of the Installation Equipment Group of the General Electric Co., Ltd., has been appointed a director of Pirelli-General Cable Works, Ltd. **Sir Leslie Gamage,** who recently retired from the chairmanship of the G.E.C., continues as chairman of Pirelli-General.

Mr. J. A. Croft has been appointed chairman of Crofts Engineers (Holdings), Ltd., and its principal operating subsidiary companies, including Crofts (Engineers), Ltd., and Carter Gears, Ltd. Mr. Croft joined the board of Crofts (Engineers), Ltd., in 1944 and of Crofts Engineers (Holdings), Ltd., on its formation in 1948. He was appointed deputy chairman and managing director of Crofts Engineers (Holdings), Ltd., in 1954, and now succeeds his father, the late Sir Arthur Croft.

Mr. J. A. Croft

Blackstone & Co., Ltd., announce that two of their directors, **Mr. E. Joyce** and **Mr. Charles Pratt,** M.C., are retiring from the board at the end of this month. Mr. Joyce, who joined the company in 1904, was appointed secretary in 1932 and a director in 1947. Mr. Pratt joined the technical sales staff of R. A. Lister & Co. in 1919 and subsequently travelled extensively in South America and Africa as a foreign sales executive. On the acquisition of Blackstone & Co. in 1936 he was appointed to the board as a resident director representing the parent company.

Mr. B. J. Hewlett has been appointed manager of the London sales office of Higgs Motors, Ltd., in succession to Mr. A. W. Fisher, B.Sc., M.I.E.E., whose retirement was recently reported. Mr. Hewlett received his technical education at the City & Guilds College and after service in the Royal Navy during the war joined Crompton Parkinson, Ltd., in 1948, serving first in the London sales office and later at Newcastle-on-Tyne. He joined Higgs Motors, Ltd., as a senior sales engineer in 1958.

Mr. B. J. Hewlett

Mr. Peter Jardine has been appointed managing director of J. G. Statter & Co., Ltd., and Minerva Mouldings, Ltd., both companies in the Metal Industries Group. He succeeds the late Lt.-Col. G. S. Marston. Mr. Jardine was born and educated in Edinburgh. He was for eight years chief accountant at the Mullard Blackburn works and for four years group controller of Parkinson & Cowan. He was appointed group chief accountant of Metal Industries in 1956 and group financial controller three years later. Recently he took up full-time duties as executive director of J. G. Statter & Co. and Minerva Mouldings.

Thorn Electrical Industries, Ltd., announce that **Mr. A. M. Scales,** previously Atlas area manager for Scotland, has returned to the London head office to take up a new appointment as marketing manager for Atlas Lighting, Ltd. His duties will include control of the Advertising and Sales Policy Departments. Mr. Scales

Mr. A. M. Scales

Mr. A. Rowlett

was responsible for the formation of the Scottish Branch of the Electrical Trades' Commercial Travellers' Association and was its first chairman. He is succeeded as Scottish area manager by **Mr. A. Rowlett,** who was previously sales supervisor.

Mr. J. G. Cooper has been appointed general sales manager of H. Frost & Co., Ltd., Walsall. **Mr. D. F. Blake,** formerly deputy sales manager, has been promoted home sales manager and **Mr. J. Turrell** and **Mr. A. Donald** have been appointed London area manager and Scottish manager, respectively. **Mr. T. A. Jackson** has been appointed manager, sales office and distribution, for both home and export markets.

Mr. J. W. Haig-Ferguson, M.A., A.M.I.Mech.E., A.M.I.E.E., has recently been appointed managing director of R. & J. Beck, Ltd. (Griffin & George Group). Mr. Haig - Ferguson was educated at Wellington College and Queen's College, Cambridge. After varied industrial experience he was appointed divisional director (electronics) of Bruce Peebles & Co., Ltd.

Mr. J. Haig-Ferguson

Mr. N. McAdam, B.Sc., who has been appointed chief engineer of the Industrial Valves and Cathode Ray Tubes Department, A.E.I. Radio and Electronic Components Division, joined the Edison Swan Electric Co. in 1935 and in 1940 was placed in charge of mains valve development. In 1947 he went to the company's valve factory at Sunderland as chief factory engineer and became divisional chief inspector for the Edison Swan Group of factories in 1955. Mr. McAdam joined Copeland & Jenkins, Ltd., of Leyton in 1958 as general manager and was appointed a director of the company last year.

Mr. N. McAdam

From 1st March the Rectifier Engineering and Semiconductor Engineering Departments of the A.E.I. Heavy Plant Division have been combined to form a single department named the Power Rectifier Engineering Department. **Mr. J. C. Read,** D.Sc., M.I.E.E., who has been manager of the Rectifier Engineering Department since 1949, is appointed divisional consultant—rectifiers, and **Mr. W. D. Sinclair,** A.M.I.E.E., manager of the Semiconductor Engineering Department since 1957, becomes manager of the new combined department.

Dr. J. C. Read

Mr. W. D. Sinclair

In his new capacity Dr. Read will not only maintain close contact with engineering and development but also with the manufacture and sale of power rectifier products of the A.E.I. Heavy Plant Division, acting as adviser to the managers of the Power Rectifier Engineering and Sales Departments. He will continue to represent A.E.I. on national and international committees dealing with power rectifiers and allied subjects. He was educated as Crewkerne School and Bristol University and during the 1914-18 war served in the Signal Corps, Royal Engineers. After graduating he joined the B.T.H. Co. as a student apprentice and subsequently entered the A.C. Engineering Department. He assisted in the design of the first British mercury arc rectifier and in 1942 became chief rectifier designer. Dr. Read is the author of numerous technical articles and papers, and has received several I.E.E. awards. He is chairman of the Mercury Arc Rectifier Committee of the British Standards Institution.

Mr. Sinclair was educated at the Heriot-Watt College, Edinburgh, and after completing a post-graduate apprenticeship course at the Rugby Works of the B.T.H. Co. he joined the vacuum physics section of the Research Laboratory in 1939. During the last war he was concerned with the design and development of valves for military radar. In 1944 he was in charge of the Research Laboratory street lighting section, and also lectured in the United States on British street lighting developments. He joined the lamp organisation in 1950 as assistant to the manager and was appointed superintendent, Lamp Works, in 1954. In 1955 he was seconded to assist in the formation of the Semiconductor Materials Engineering Development and Manufacturing Departments.

The board of Livingston Laboratories, Ltd., has been extended to provide for the future development of the company. The new board consists of **Mr. F. Livingston Hogg** (chairman and joint managing director), **Mr. D. C. Rennie** (joint managing director), **Mrs. M. R. Hogg** and **Messrs. H. Sellers, S. W. Urry** and **F. R. G. Webb. Mr. S. T. Richardson** has been appointed secretary-accountant. The company also announces the appointment of **Mr. N. L. Glew** to the new post of Midlands field engineer.

In reporting the appointment of **Mr. G. P. Thompson** as general manager, Rugby Works, with A.E.I. (Rugby), Ltd., in last week's issue, we regret that, by mistake, a photograph of Mr. R. Thomson (also of A.E.I.) was inadvertently included. We apologise for the error; a portrait of Mr. G. P. Thompson is now reproduced.

Mr. G. P. Thompson

Electrolux, Ltd., have appointed **Mr. Maurice Gomme** as sales manager for the new "Dishmaid." Since May last year he has been on the staff of the general sales manager at the head office.

The North Western Electricity Board has appointed **Mr. H. Howitt,** B.Sc.Tech., first assistant commercial engineer, Rochdale District, as district commercial engineer, Macclesfield.

Following the appointment of Mr. B. W. Ricks as deputy chief engineer of the Eastern Electricity Board, **Mr. G. M. Holland,** M.I.E.E., has been appointed engineer, Northmet Sub-Area, and is succeeded as engineer of the Essex Sub-Area by **Mr. C. C. Brazier,** A.M.I.E.E., at present engineer of the Norfolk Sub-Area.

Mr. G. M. Holland

Mr. C. C. Brazier

Ten British university professors are to lecture at Soviet universities during the next two months under arrange-

ments made between the British Council and the Ministry of Higher Education of the U.S.S.R. They include **Prof. M. G. Say,** Ph.D., D.I.C., F.R.S.E., of the Heriot-Watt College, Edinburgh, who will lecture on electrical machines (3rd to 18th April). A number of Soviet professors are also visiting British universities.

Mr. E. Ledgard, A.M.I.E.E., A.M.C.T., has been appointed manager of the Woking District of the South Eastern Electricity Board to succeed **Mr. E. Peel,** M.I.E.E., who becomes manager of the Board's Sutton District on the retirement of **Mr. W. B. Hayden,** M.I.E.E., in April next. Mr. Ledgard is at present district engineer of the Gravesend District. He had previously held appointments with the Rochdale, Dover and Paisley Corporations.

Mr. H. F. Bibby, B.Sc.Tech., A.M.I.E.E., A.M.I.Mech.E., has been appointed general manager of Associated Electrical Industries Export, Ltd. Mr. Bibby was a college apprentice at the Metropolitan-Vickers works, Trafford Park, and graduated at Manchester University. He was transferred to the M-V Export Co. in 1939 and while at The Hague as liaison engineer he escaped to England with his wife three days after the German invasion in May, 1940. During the war he was engaged on development work in the Motor Engineering Department, Trafford Park, and in 1945 returned to Holland to establish and manage a new office at The Hague.

Mr. H. F. Bibby

In 1951 Mr. Bibby spent some time in Argentina, Chile and Uruguay, and was subsequently appointed manager of the American Division of the M-V Export Co. in London. He became assistant general manager in 1956 and in 1957 joined the board, being appointed general manager later the same year. When A.E.I. Export was formed in 1959, Mr. Bibby became director of administration.

Johnson & Phillips, Ltd., have made new appointments in their home sales organisation.

Mr. J. C. Robertson, D.F.H., M.I.E.E., previously London branch manager, has been appointed sales manager (home) and will be assisted by **Mr. C. W. Cawte,** B.Sc.(Eng.), A.M.I.E.E., who continues as sales manager (cables) and by **Mr. R. L. Stanley,** D.F.H., A.M.I.E.E., who becomes sales manager (plant). **Mr. B. E. Leeson** having reached the company's normal retiring age has, at his own request, been relieved of his sales management duties but will continue in a senior sales capacity particularly relating to the sale of switchgear in certain areas. **Mr. R. A. Jones,** A.M.I.E.E., has succeeded Mr. Robertson as London branch manager.

Mr. J. C. Robertson

Mr. R. L. Stanley

Mr. R. A. Jones

Three hundred members and friends attended the 16th annual dinner and dance of the **J. & P. Staff Association** at the Yorkshire Grey Hotel, Eltham, on 17th February. This was the largest attendance for some years and included forty from provincial branches. The toast of the Staff Association was proposed by Mr. W. Glass, M.I.Mech.E., chairman and managing director of the company, and the response was made by the chairman of the Association, Mr. W. E. Curtis.

Following the annual general meeting of the Electronic Engineering Association on 21st February the new Council elected as chairman **Dr. D. N. Truscott** (General Electric Co., Ltd.), in succession to Mr. L. T. Hinton (Standard Telephones & Cables, Ltd.). **Mr. W. D. H. Gregson** (Ferranti, Ltd.) was elected vice-chairman, in succession to Mr. R. R. C. Rankin (Mullard Equipment, Ltd.).

Organisational changes announced by the Midlands Electricity Board last November included the amalgamation of the South Staffs. and North Worcs. Sub-Area with the Wolverhampton and District Sub-Area. It is now announced that **Mr. H. A. P. Caddell,** M.A., M.I.E.E., at present manager of the South Staffs. and North Worcs. Sub-Area, has been appointed manager-designate of the new combined Sub-Area. From 1st April he will be relinquishing his present appointment at Tipton to devote himself to the preliminary work involved. **Mr. D. Holt,** B.Sc.Tech., M.I.E.E., manager of the Wolverhampton and District Sub-Area, while retaining this appointment, is also to be acting manager of the S. Staffs. and N. Worcs. Sub-Area pending the completion of the amalgamation.

Mr. H. A. P. Caddell

Mr. D. Holt

The guest speaker at the February luncheon meeting of the **Batti-Wallahs' Society** was Captain C. B. Lister, of the Port of London Authority, who gave an entertaining address on his life at sea during the past 50-odd years. His talk, entitled "The Merchant Service," was in fact one of those fascinating yarns of the sea that only a seafaring man such as himself could spin. Mr. J. S. A. Bunting, president, was in the chair and a vote of thanks to the speaker was given by Mr. C. A. J. Martin, a past-president.

The next meeting will be on Thursday, 30th March, when the speaker will be Sir William McFadzean (chairman and managing director, British Insulated Callender's Cables, Ltd.), who will speak on "The European Situation." Members are reminded that the annual Ladies' Night will be on Friday, 17th March.

Mr. P. J. Daglish, B.Sc., M.I.E.E., M.I.Mech.E., A.F.R.Ae.S., who last September joined D. Napier & Son, Ltd., as a special executive, has now been appointed to the board as commercial director. Before joining Napier, Mr. Daglish was manager of the English Electric Co.'s Aircraft Equipment Division.

Mr. E. T. Card has been appointed a director of Electrothermal Engineering, Ltd.

OBITUARY

Mr. H. V. Spencer.—The death occurred suddenly on 25th February of Mr. Horace Victor Spencer, sales director of the Z Electric Lamp & Supplies Co., Ltd. He was fifty-five.

Mrs. R. D. Reynolds.—We regret to report the death on 24th February of Mrs. Ida Reynolds, wife of Mr. R. D. Reynolds of the British Electrical Development Association.

INDUSTRIAL NEWS

Domestic Appliance Approval

"Kite Mark" Adapted

THE General Council of the British Electrical Approvals Board met for the first time, under the presidency of Lord Citrine, on 21st February. Lord Citrine referred to the growing concern in this country about consumer welfare and to a number of bodies, both independent and within industry, which were already doing valuable work in the consumers' interest. He said that the B.E.A.B. took the process one step further by bringing together all the organisations interested in the sustaining and improving of standards of safety in electrical appliances. He stressed the importance of the Board's independence and integrity.

On the eve of the announcement of the first group of approvals, it was made clear that the scheme was necessarily a long-term one and until a considerable number of marked appliances were available in the shops —a process which would take many months—publicity would be concentrated on informing distributors and retailers about the scheme and preparing the public only in general terms.

The approval mark (reproduced herewith) incorporates the kite shape

Approval mark for domestic appliances

already made familiar by the B.S.I. "Kite Mark," which it will supersede in the field of domestic electrical appliances, and emphasises that approval is based on published standards. B.E.A.B. is not intending to pass judgment on the relative usefulness of an appliance since this factor cannot be divorced from considerations such as price, and can more appropriately be dealt with by consumer organisations.

Certificates of approval were sent last Tuesday to the successful manufacturers in the first group (radiant fires, kettles, blankets and vacuum cleaners). Mr. T. E. Daniel, chairman of the North Western Electricity Board, is chairman of the Board of Management, and the director is Mr. C. A. Zweigbergk, 27, Cockspur Street, London, S.W.1.

Higher Output Expected by English Electric

OUTPUT of the English Electric Co., Ltd., in 1960 was practically identical with that in 1959, but orders booked last year were substantially higher than ever before and as a result there are good prospects for an increased output in 1961. This is stated by the chairman, Lord Nelson of Stafford, in his address circulated to shareholders.

Referring to the immense developments in the electrical industry since the war, Lord Nelson says that the company has equipped itself, both in research and production facilities and in trained manpower, to meet any further demands that may be made on it. The substantial investment which has been necessary has not yet reached the earning stage, but the increased order book provides the basis for coping with this problem.

Though the negotiations with the General Electric Co. were not successful they show that rationalisation, whether by means of a merger of interests, research agreements, or other methods of making better use of the industry's resources, both human and mechanical, is constantly under review. Unfortunately the word rationalisation is sometimes misunderstood, Lord Nelson says. It should not raise fears in the minds of those who work in industry because of changes that may take place in their employment, for the aim of such moves is to bring more work to this country and to ensure greater stability of employment.

The company's main difficulty during the year was to meet low price competition and the offers of better credit financing terms. Lord Nelson emphasises that 50 per cent of the company's costs are for raw materials and manufactured accessories and he believed their suppliers must also concentrate on cost reduction and thus share the responsibility of obtaining overseas business now being lost to foreign competitors.

The substantially better results of the parent company and certain subsidiaries in 1960 were offset by losses made by Napiers and subsidiaries in Italy and Canada. The accounts were summarised in the *Electrical Review* of 24th February.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £186 0s 0d
COPPER, H.C. Electro	ton £229 5s 0d
Fire Refined 99·70%	ton £228 0s 0d
Fire Refined 99·50%	ton £227 0s 0d
COPPER Tubes ..	lb 2s 2½d
Sheet	ton £262 10s 0d
H.C. wire and strip	ton £281 5s 0d
LEAD, English ..	ton £64 15s 0d
Foreign	ton £63 0s 0d
MERCURY	flask £69 0s 0d
TIN, block (English)..	ton £803 0s 0d
ZINC, G.O.B. Foreign	ton £84 5s 0d
BRASS Tubes (solid drawn)	lb 1s 10d
Wire	lb 2s 8¾d
PHOSPHOR BRONZE Wire	lb 4s 1¼d
PLATINUM ..	oz £30 5s 0d
RUBBER, No. 1 R.S.S. spot	lb 24¾d—25d

SPECIAL LANTERNS FOR THE CITY

The General Electric Co., Ltd., is to supply more of the special vertical lanterns first used to light the London Wall section of Route 11 last July. The order is for 32 lanterns for dual mounting and 16 of similar design for post-top mounting. The octagonal lanterns are of the "City of London" type. Each contains four 80 W "Osram" fluorescent tubes with operating gear, and will be supported on G.E.C. octagonal, continuously tapered steel columns. Mr. F. Forty, the city engineer, designed the lanterns in collaboration with the G.E.C. Lighting Division. Each carries the City of London coat-of-arms. Installation will be carried out by the London Electricity Board.

Large Transformer Order

Johnson & Phillips, Ltd., have received an order from the Central Electricity Generating Board for transformers worth about £250,000 for installation at the St. Marylebone and Grove Road substations in the London Division.

INDUSTRIAL NEWS *[continued*

Higher Charges in London

TARIFF revisions which will apply to electricity consumed following the meter readings taken after 31st March next were announced by the London Electricity Board on Tuesday. They consist of an increase from 1¼d to 1⅜d in the "unit" charge of the domestic and other two-part rates; increases in certain flat rates other than for lighting; and adjustments to other rates. No change is proposed in the rates for restricted-hour off-peak supplies.

The Board also announced the introduction of a standard tariff for industrial supplies which will replace all existing industrial tariffs and will complete the standardisation of electricity tariffs in the Board's Area.

On the proposed increases, the Board stated that the cost to domestic consumers, on average, would be about 6d per week. During the last twelve years the average price per kWh sold by the Board had increased by only 22 per cent—much less than the increase in cost of most other commodities and services.

The Consultative Council, after discussing the proposals with the chairman and officers of the Board, agreed that the tariff changes were not such as to call for objection on their part. They regretted, however, that the Generating Board had not been able to provide in their bulk supply tariff some further tariff encouragement for the off-peak use of electricity.

G.E.C. Take-over Offer

An offer to acquire Radio & Allied (Holdings), Ltd., has been made by the General Electric Co., Ltd. The amount involved is said to be about £8 million.

Radio & Allied (Holdings) was formed as an amalgamation of the Sobell and McMichael radio and television concerns.

Domestic Equipment Makers' Expansion

ANNOUNCING a number of board changes, A. J. Flatley, Ltd., state that the purpose is to equip the company for more intensive expansion and diversification in the domestic equipment field. Mr. Roger B. Pursey, managing director of the Ocean Trust Co., Ltd., is joining the board; Sir Edward Behrens, chairman of Ocean Trust, also joins the board and will act as financial adviser; and Mr. G. D. Broadfoot, who has been the company's chief designer for some time, becomes joint managing director with Mr. A. J. Flatley, who remains chairman.

A new range of products is planned, including a 4½ cu ft compressor type refrigerator, to sell at 39 gns, which is already in production. A twin-tub washing machine, to be announced soon, will have a basic price of 39 gns, with a heater model available at 6 gns extra. Plans are also well advanced for a popularly-priced disposal unit.

A factory is being built in Southern Ireland to concentrate on production for the Continental markets.

Running Cost of All-Electric Flats

South Shields Town Council has received a report on the cost of electrical services in 25 all-electric flats which have been occupied for 12 months. Only six of the 25 tenants were dissatisfied with the system of under-floor heating, on the grounds that it was inadequate in very cold weather. The cost of heating worked out at 6s 9d a week. The all-in cost for heating, cooking, lighting, etc., in two-bedroomed flats was 17s 5d a week and for three-bedroomed flats 19s 10d.

Kitchen Planning

Winning entry in the E.A.W. kitchen planning photographic competition

THE winners of the kitchen planning photographic competition held by the Electrical Association for Women were:—1st, Mrs. G. M. Stephens (Perry Barr); 2nd, Mr. and Mrs. J. A. Tatchell (Billingham, Co. Durham); and 3rd, Mrs. M. S. Godden (Coventry). The judges were Viscountess Kilmuir, D.B.E. (E.A.W. president), Mrs. Alice Hope (*Daily Telegraph*) and Mrs. M. E. Pickford, B.Sc. (education officer of the Association).

The winning entry showed a kitchen 9ft square which had electric underfloor heating; fluorescent lighting; six 13 A socket outlets; a convenient sequence of work centres with plenty of work surfaces; and adequate and well-placed storage accommodation. A dinette adjacent to the kitchen included a refrigerator.

SWITCHGEAR ORDERS

Orders for switchgear valued at nearly £100,000 have been received by J. G. Statter & Co., Ltd., a member of the Metal Industries Group. Johannesburg Municipality is purchasing h.v. metalclad fuse switch and isolator units worth £40,000; the Admiralty has ordered h.v. switchgear valued at £38,000 for the Devonport and Portsmouth dockyards; and the Central Electricity Board of Malaya has placed contracts for metalclad switchgear valued at £21,000.

Fault-Finding Booklet

A series of booklets on fault-finding in electrical circuitry is being issued by the Pyramid Instrument Corporation, a different subject being dealt with each month. The first booklet, entitled "Trouble Shooting Motors with a Volt Ammeter," is now available from the Pyramid Instrument Corporation, Sales Division, H. J. Baldwin & Co., Ltd., 221, Grand Buildings, Trafalgar Square, London, W.C.2.

INDUSTRIAL NEWS *[continued*

B.E.A.M.A. Constitutional Changes

THE Council of the British Electrical and Allied Manufacturers' Association has drawn up proposals for the revision of the Association's constitution, "so as to bring it up to date and ensure that the B.E.A.M.A. is equipped to play its proper part in the affairs of the industry and of the nation in the years ahead." Accordingly, at an extraordinary general meeting to follow the annual general meeting on 16th March certain changes will be put before the members for approval; they are briefly as follows:—

The offices of president and chairman are to be combined under the title of president. The president will preside at Council meetings, annual general meetings and other important functions. The Council considers that this change will enhance the status of the senior office bearer of the Association, ensure that he is from the electrical industry and that it will be more logical than the present arrangement. The office of chairman will thereupon lapse. The office of deputy president will be created and the holder will normally be regarded as next in succession to the president.

To secure the continuing help and guidance of senior members of the industry who have held the office of president or chairman and may not feel able to continue to be their firms' representatives on the Council, a new office of counsellor is proposed. The Council will have the power to invite to this office those who have held the office of president or chairman and are either directors or full-time executives of a member firm. Counsellors will hold office for a year and be eligible for re-appointment. They will be entitled to attend Council meetings and receive papers but not to vote. As a result of these changes, the existing vice-presidents will not be re-elected and the office will be abolished.

If they are approved the changes will come into operation at the first Council meeting after the annual general meeting when the Council elects its officers.

The opportunity is also being taken to bring the remaining Articles up to date and to comply with the 1948 Companies Act by introducing a series of minor amendments.

Electricity Sales Reflect Industrial Activity

THE analysis of electricity sales in January issued by the Electricity Council shows that the highest increases were in the mainly industrial areas in the north, the Yorkshire Board leading with 19 per cent followed by the North Eastern and North Western Boards both with 16·9 per cent. The average rate of expansion for the twelve Area Boards was 13·3 per cent (11·2 per cent when adjusted for weather conditions and the number of working days in the month).

Good progress was also made in Scotland, sales by the South of Scotland Board having risen by 16·5 per cent and those of the North of Scotland Hydro-Electric Board by 15·9 per cent. In addition to electricity generated at its own stations, the South of Scotland Board imported 92·2 million kWh (against 9·2 million) from the C.E.G.B., 49 million kWh (87·6 million) from the North of Scotland Board and 88·4 million kWh (50·2 million) from the U.K.A.E.A.

ELECTRICITY SENT OUT BY BOARDS FOR THEIR CONSUMERS

Board	Totals for January (million kWh)			Twelve Months' Totals Ended 31st January (million kWh)		
	1960	1961	Inc. or Dec. %	1960	1961	Inc. or Dec. %
London	992·6	1,117·8	+12·6	8,062·3	9,129·6	+13·2
South Eastern	671·6	753·6	+12·2	5,589·8	6,451·5	+15·4
Southern	866·0	990·8	+14·4	7,313·7	8,636·5	+18·1
South Western	385·7	426·8	+10·7	3,458·7	3,960·0	+14·5
Eastern	1,042·9	1,170·7	+12·3	8,875·9	10,259·5	+15·6
East Midlands*	820·8	928·2	+13·1	7,436·7	8,460·5	+13·8
Midlands*	1,100·2	1,231·6	+11·9	9,758·0	11,179·4	+14·6
South Wales*	541·8	583·5	+ 7·7	5,459·7	6,072·9	+11·2
Merseyside and N. Wales* ...	603·9	681·1	+12·8	5,765·8	6,561·5	+13·8
Yorkshire*	1,018·3	1,211·4	+19·0	9,389·1	11,091·7	+18·1
North Eastern*	563·9	659·0	+16·9	5,470·9	6,234·7	+14·0
North Western*	1,014·0	1,185·5	+16·9	9,497·9	10,920·4	+15·0
Total All Area Boards	9,621·7	10,940·0	+13·7	86,078·5	98,958·2	+15·0
Direct Supplies by C.E.G.B. ...	329·6	336·7	+ 2·2	3,479·9	3,784·7	+ 8·8
Grand Total	9,951·3	11,276·7	+13·3	89,558·4	102,742·9	+14·7
Mainly Industrial Areas*	5,662·9	6,480·3	+14·4	52,778·1	60,521·1	+14·7
Mainly Non-Industrial Areas ...	3,958·8	4,459·7	+12·7	33,300·4	38,437·1	+11·5
South of Scotland E.B.	786·2	915·6	+16·5	7,157·8	8,181·7	+14·3
North of Scotland H.E.B. ...	182·0	211·0	+15·9	1,615·9	1,857·7	+15·0

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

Pump Motors for Drakelow

THE Heavy Plant Division of Associated Electrical Industries, Ltd., has received an order from Drysdale & Co., Ltd., for the main circulating water pump motors for Drakelow "C" power station. Six 3,500 h.p., 333 r.p.m., 11 kV unity power factor, salient-pole synchronous motors are required to drive the pumps, which together are capable of delivering 40 million gallons of water per hour to the condenser cooling system.

The choice of salient-pole synchronous motors by the C.E.G.B. represents a significant change from the established power station practice of using induction motors, and recognises the advantages of synchronous machines for large power driving units. These advantages include the economic use of direct drive to the pumps without the use of reduction gearing; superior efficiency; and minimum kVA input to machines operating at unity power factor.

Women Engineers in Russia

The training and employment prospects for women engineers in the Soviet Union are very little different from those of men. Women are successful in engineering work at all levels and make an enormous contribution to the technical effort of the country. These are among the conclusions reached by Miss L. S. Souter, B.Sc., A.R.T.C., A.M.I.E.E., and Miss R. Winslade, M.S.I.T., in a report on the education, employment and prospects of women in the U.S.S.R., which they presented at a meeting of the Electrical Association for Women in London on Monday.

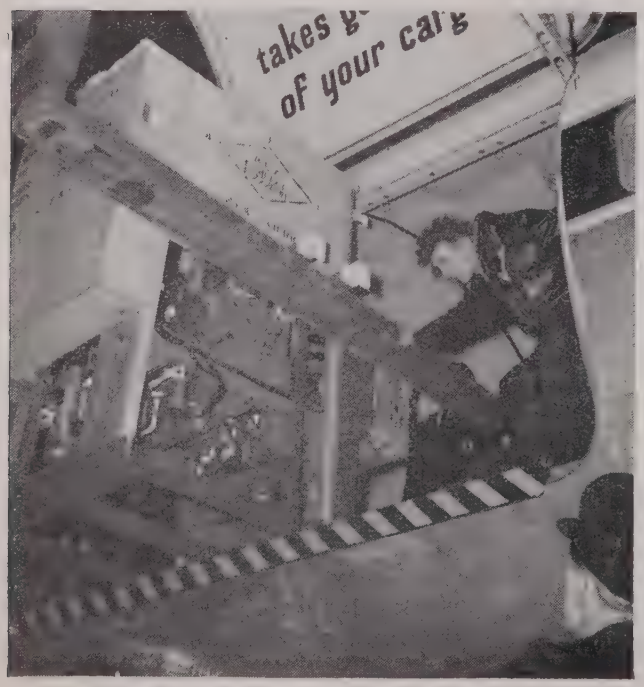
The authors also found that acceptance of women in the profession had been helped by the rapid social and technical development of the country and by co-education. Women engineers were found to be happy in their work and felt frustrated when they had to leave it.

INDUSTRIAL NEWS *[continued*

Mass Spectrometer for America

A SPARK-SOURCE mass spectrometer made by A.E.I. (Manchester), Ltd., for the Radio Corporation of America, Princeton, was dispatched by air on 22nd February. This type MS7 instrument is valued at over £20,000 and the order was secured against intense American competition. It is the first instrument of its kind to be supplied abroad, but other MS7 mass spectrometers are in the process of being manufactured for Holland, France, Germany, Switzerland and the U.S.S.R.

Spark-source mass spectrometry provides a highly sensitive method of impurity determination in solids, and enables qualitative and quantitative analyses to be made of impurities at concentrations as low as one atom in 10^9 atoms. Features of the method that have proved particularly attractive are the simplicity of the spectrum obtained, which permits easy identification of the elements, with very little overlap, and the fact that the whole range of solid elements from lithium to uranium can be focused in a single exposure. The sensitivity of the method is approximately equal for all elements. One of the principal fields of application of spark-source mass spectrometry is in semiconductor research.



A.E.I. type MS7 spark-source mass spectrometer being loaded at Ringway Airport en route for the Radio Corporation of America, Princeton

World Plastics Progress

ALREADY over 350 firms from thirteen countries have arranged to display their products at this year's International Plastics Exhibition—Interplas 61—in London from 21st June to 1st July next. The complex array of modern plastics materials to be seen at Olympia will include an extensive range of typical end uses, both current and potential, and many new materials now under development will be shown. Many thousands of finished products will also be on view, illustrating the most up-to-date contributions of plastics to consumer goods and industrial components. The exhibition is organised by the Iliffe journals *British Plastics* and *International Plastics Engineering* with the co-operation of the British Plastics Federation. Tickets and further information about the exhibition can be obtained from Iliffe Exhibitions, Ltd., Dorset House, Stamford Street, London, S.E.1.

FLOOR-WARMING IN RACECOURSE ENCLOSURE

A new three-storey stand accommodating 220 seated and 2,000 standing spectators in the Tattersall's enclosure at Cheltenham racecourse has been equipped with underfloor heating and a 200ft long single-storey administration block is warmed by the same method. The B.I.C.C. Panelec solid embedded system is used in which the heating cables are held in position in the floor screed by plastic spacer bars.

CRYSTAL FILTERS

Under an agreement reached between Marconi's Wireless Telegraph Co., Ltd., and the Itek Corporation (U.S.A.), Marconi's are to manufacture the Itek Electro-Products Company's range of "Hermes" crystal filters, which they will be permitted to market in every country in the western world outside the United States. In addition, larger equipments made by Marconi's which may include these crystal filters and discriminators can be sold in the United States on a non-exclusive basis. The agreement is for five years, with provision for extension. It also provides for future licensing of manufacturing rights in other Marconi plants and affiliated companies throughout the world.

W. H. Allen Works Extensions

Work has recently commenced on a new pump test house and a research laboratory at the Bedford works of W. H. Allen, Sons & Co., Ltd. The pump test house, a single-storey main building with an annexe on each side, will contain a 30-ton crane and a large sump, 20ft deep by 32ft by 21ft, and will provide facilities for the testing of pumps of all capacities up to 120,000 gal of water per minute. Each annexe will be equipped with a 3-ton crane to handle the change-over of 6ft diameter test pipes. The main research laboratory will comprise a two-storey office block and an adjoining single-storey laboratory.

RHEOSTATIC COMPANY'S NEW BIRMINGHAM OFFICES

Lichfield House, 38, Smallbrook, on the Birmingham Ringway, is to be the new Midlands headquarters of the Rheostatic Co., Ltd., under Mr. J. S. Smith, the company's Midland area manager. The telephone number is Midland 8476. The Rheostatic Co. will also be representing Black Automatic Controls, Ltd., another member of the Elliott-Automation group, in the Midlands, selling its range of solenoid operated valves, pressure and flow switches to the heating, ventilating and air conditioning industries under the name of "Black-Satchwell."

Mauritius Power Project

The Central Electricity Board in Mauritius is reported by Barclays Bank D.C.O. to have decided to proceed with the construction of a 40 MW diesel station in the Port Louis harbour area. The first stage is estimated to cost £1,050,000 and the work is due for completion in 1963.

Philips Domestic Appliance Plans

Philips Electrical, Ltd., are entering the United Kingdom market in major domestic appliances. This new venture is planned for 1962, but a new group within the company to handle such products is already being formed under the commercial management of Mr. H. W. Thompson who before joining Philips last December was industrial sales manager with A.E.I.-Hotpoint, Ltd. Mr. H. N. Pantlin and Mr. B. N. Lewis are also in the new group. Philips already sell major domestic appliances in several other countries.

AREA BOARDS' APPLIANCE SALES

EXCEPT for cookers and water heaters, sales of the major types of domestic appliances by Area Boards fell sharply in 1960 after the boom period preceding the re-introduction of hire-purchase restrictions. As will be seen from the accompanying table

	Month ended 31st December		Twelve months ended 31st December	
	Total	Change %	Total	Change %
Cookers ...	29,164	− 3·5	339,823	+ 1·2
Water Heaters:				
Immersion ...	7,355	+17·3	192,441	+ 1·9
Storage ...	4,428	−12·9	67,411	+11·3
Wash Boilers	3,655	−20·3	56,018	−16·5
Washing Machines ...	6,446	−47·8	111,116	−32·3
Refrigerators	4,762	−21·5	139,291	−15·8
Clothes Dryers	8,332	−36·3	57,819	n.a.

issued by the Electricity Council, sales of washing machines and refrigerators were down by 32·3 and 15·8 per cent respectively. The numbers sold, however, remained well above the level of earlier years as the following figures show:—Washing machines: 1957—73,545; 1958—103,838; and 1959—164,037. Refrigerators: 1957—50,030; 1958—75,182; and 1959—165,431. Area Boards' sales, of course, represent only a part of the total throughout the country.

Flat Oil-filled Cables for Nigeria

Enfield-Standard Power Cables, Ltd., has been awarded a £200,000 contract by the Electricity Corporation of Nigeria for 15 miles of 33 kV flat oil-filled pressure cable. The contract also includes 11 kV cables, control cables and overhead line circuits for the Lagos distribution system. This will be the first time that 33 kV underground cables have been laid in Nigeria and the flat oil-filled pressure cables will be the first to be used in any project in Africa. The consulting engineers are Messrs. Preece, Cardew & Rider.

Sign Design Competition Results

THE judging of the illuminated sign design competition sponsored by the Electrical Sign Manufacturers' Association took place on 22nd February when the first prize of £150 was awarded to Mr. G. Nash (West Wickham, Kent); the second prize of £75 to Mr. T. R. Crabtree (Prescot, Lancs.); and the third prize of £40 to Mr. H. Kirotar (London, S.E.4). Consolation prizes of £10 each were awarded to Mr. C. S. Green (London, S.E.26), Mr. R. C. Hammond (Chislehurst, Kent), Mr. G. E. Milton (Erith, Kent), Mr. L. Summers (Richmond, Surrey) and Mr. M. D. Cross (Quinton, Birmingham). The prize of £20 for the best entry from a competitor under 21 years was awarded to Mr. R. A. Shaw (Liverpool).

The general view of the judges was that the standard of the design and presentation of most of the 224 entries was high. The winning design particularly attracted the judges for its originality, and because it made full use of the large panel above the facia. The judges were Lord Mancroft, Sir Basil Spence, Mr. G. S. Campbell and Mr. S. D. Moyse, president and vice-president respectively of the Association. The president of the Town Planning Institute, Mr. R. Nicholas, was unfortunately indisposed and unable to attend.

The winning design in the competition sponsored by the Electrical Sign Manufacturers' Association

TRADE ANNOUNCEMENTS

The technical sales offices and stores of **Smart & Brown (Engineers), Ltd.**, are now at Menin Works, Bond Road, Mitcham, Surrey (telephone: Mitcham 0154-6).

Mantel Metalworkers, Ltd., announce the centralisation of their offices at 121, Gurney Street, London, S.E.17 (telephone: Rodney 6441-3). The offices at 50, Stuart Road have been closed to make way for a new machine shop. A showroom to house a permanent comprehensive display of the company's products is being equipped at Gurney Street.

Preformed Line Products (Great Britain), Ltd., have appointed Mr. W. H. Stewart, Graduate I.E.E., 58, Dower Walk, Gossops Green, Crawley, Sussex, as a technical representative.

The telephone number of **E.M.I. Electronics, Ltd.**, and other companies in the E.M.I. Group at Hayes, Middlesex, will be changed from Southall 2468 to Hayes 3888, on 24th April.

The Recording and Relay Equipment Division of the **Gramophone Co., Ltd.**, has been transferred to E.M.I. Electronics, Ltd. Products handled by the Division include sound studio equipment, professional tape recorders, and wired television systems. Mr. P. Dye continues as divisional manager, Mr. L. S. Goddard will control audio equipment and Mr. T. G. May will handle wired television systems.

Adrema (Holdings), Ltd., has reached agreement with Siemens & Halske Akt. Ges., Munich, to market the "Productograph" production control equipment.

CHANGE OF NAME

The Mond Nickel Co., Ltd., an affiliate of the International Nickel Company of Canada, Ltd., has changed its name to the International Nickel Co. (Mond), Ltd.

Fan Heater

Owing to a misprint, the price of the Morphy-Richards "Bermuda" 2 kW fan heater was given in last week's issue (p. 345) as £8 8s 6d; this should have read £8 18s 6d.

NEW ELECTRICAL EQUIPMENT

INDICATOR LAMP ASSEMBLIES

A range of 6, 10 and 15 W indicator lamp assemblies, suitable for panel mounting, is announced by the Components Division of LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., Rugeley, Staffs. These indicators can be supplied with a standard glass retaining bezel or alternatively with a solid guard ring to protect the glass from damage. The terminations which have been evolved to save installation cost have provision for slide-on terminals and, as an alternative, soldered connections. The s.b.c. holder is also suitable for printed circuit applications and is available as a separate component item. The lamp assemblies are compact, chromium plated and splash-proof.

"MAN COOLER" FANS

The introduction of a new line of transportable "Man Cooler" fans is announced by W. G. CANNON & SONS, LTD., 38a, St. George's Drive, London, S.W.1, the heating and ventilating engineering company of the Chamberlain group. Primarily designed to provide relief to operators working in foundries or in close proximity to furnaces and steam raising plants, the units are intended for continuous use in any industrial "hot spot." They project a stream of cooling air where it is most needed and can be easily moved to the required positions.

The fans are fitted with high-efficiency axial flow type impellers of aluminium alloy and are driven by amply rated totally enclosed motors. They are in two sizes with aperture diameters of either 18 or 22in. Both tripod and cradle mounted types are available.

HEAVY DUTY CONTACTORS

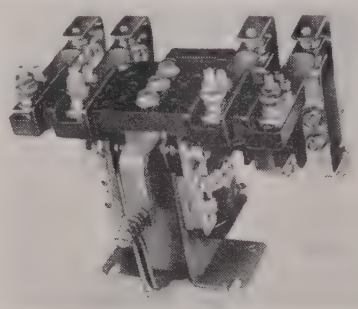
The two new contactors, types BC and LC, announced by LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20, both incorporate insulators moulded from a glass-loaded dough moulding compound and carry the contact blades in recessed slots. Both types of contactor have a laminated chassis and armatures.

In the type BC the armature pivots between ball bearings and in the LC unit the armature pivot is a stainless steel rod and brass bush. The coils for both types can be operated on a.c. or d.c. supplies up to 600 V a.c. or 250 V d.c. The power demand varies from 8 to 20 VA on a.c. and 4 to 6 W d.c.

The contactors are available in two- and four-pole versions only, with any combination of normally open, normally closed or changeover contacts. Up to two sets of auxiliary contacts can be fitted. The main contacts are either of silver or tungsten and the respective current ratings are 20 or 5 A at 250 V a.c., 1 or 1·5 A at 250 V d.c. with a non-inductive load or 15 or 5 A at 440 V a.c. The auxiliary contacts are rated at 4 A 250 V a.c. Each contactor can be offered in plug-in form.

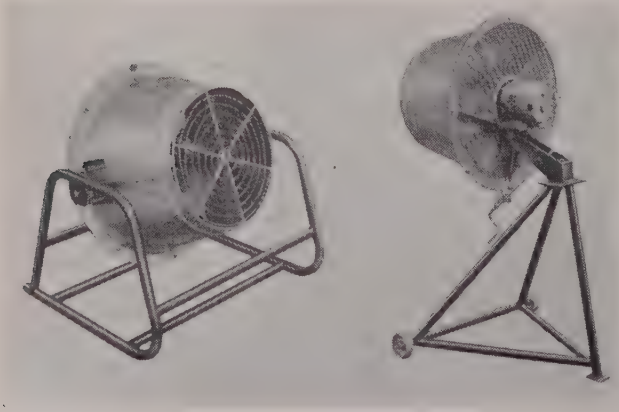
ELECTRICAL EQUIPMENT DRYING

Portable apparatus for the *in situ* detection of faulty insulation in electrical equipment and the removal of moisture causing such a failure is now available from the Marine Depart-



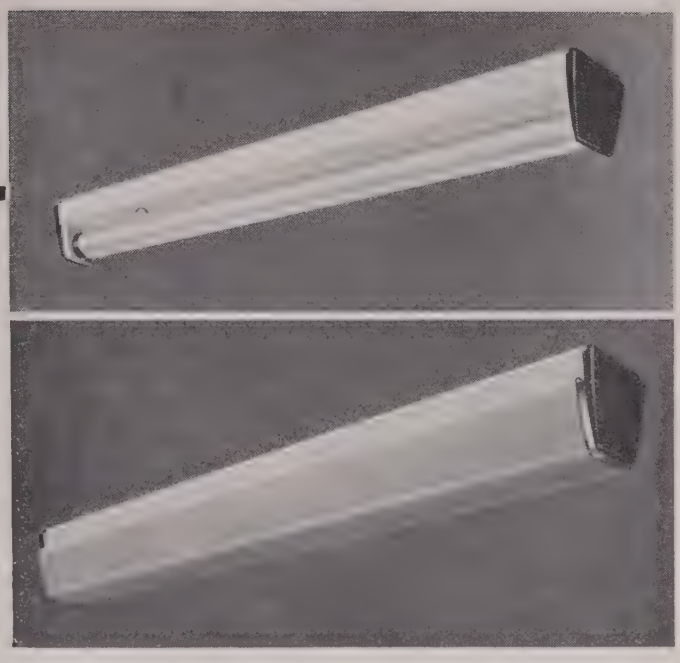
Londex type BC heavy duty contactor

A.E.I. portable E.A.F. equipment for testing and drying electrical gear affected by moisture



Two of the new Cannon "Man Cooler" fans

Lancashire Dynamo Electronic Products indicator lamps



A "Crompack" strip fitting and (below) a "Crompack" fitting with reeded plastic diffuser (Crompton Parkinson, Ltd.)

ment of the A.E.I. TELECOMMUNICATIONS DIVISION, Woolwich, London, S.E.18.

The apparatus, known as E.A.F. equipment, is made in Norway by Marinens Hovedverft, Horten, and it passes a low potential drying current through the circuit whose insulation has been found faulty. The unit is fitted with a voltmeter and ammeter and a megohmmeter on which the insulation resistance can be continuously monitored. There are also a resistance thermometer which indicates the temperature of the conductor during drying and a thermostat which controls the drying temperature so that overheating of the conductor and insulation is avoided. A graph on the top plate of the instrument shows the relationship between the current carrying capacity of the conductor being treated, the heating effect of the drying current, and the life of the cable under various drying conditions.

The equipment, which measures approximately 15¾in by 15¼in by 21½in, operates from 220 V 50-60 c/s a.c. and a convertor is required for ships with d.c. mains. Output terminals cater for cable sizes of 3/·036, 7/·029, 7/·036, 7/·044 and 7/·052 and there is an additional cable terminal marked "O." Output voltage ranges are nominally labelled 2, 5, 10, 15, 20, 25, 30 and 60 V a.c. respectively. A maximum output of 2 kVA is available.

To dry out a faulty cable the remote end is short-circuited and the cores—or groups of cores in multi-core cables—are connected to the equipment. The correct drying current is chosen for a particular size of cable from a table and the voltage required to supply that current found by experiment. During drying, a test button can be depressed to switch off the drying current and switch in the megohmmeter to show the insulation resistance of the cable while it is warm, so that any latent insulation faults are more readily detected. As the cable temperature rises, any moisture present moves towards the extremities where the concentration rises rapidly, but because the supply voltage is low there is no flashover. Temperature rises above the ambient level cause the moisture to be rapidly evaporated.

If a larger cable has to be dried, the terminal marked "O" is employed. Thermostatic control does not operate in this case and the ammeter and voltmeter are used as checks. Damage to the cable through overheating will not result, and the equipment is protected against overloading by automatic fuses. Motor testing and drying out can be done by testing through the supply circuit or by connecting directly into the terminal board of the motor, in which case the heating is largely achieved by utilising the iron losses.

FLUORESCENT FITTINGS

A new range of fluorescent fittings with attractive design features is announced by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2. Available with 8, 5 or 4ft fluorescent tubes and full-size switch-start gear of low-loss design, the basic "Crompacks" may be converted for industrial or commercial use by the simple addition of reflectors, diffusers, or frames.

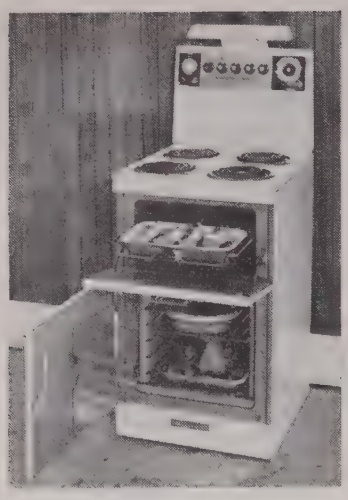
Single-handed installation is facilitated as only the full length backplate has to be fixed to the ceiling or suspension and, after locking open for wiring, the body of the fitting is quickly attached by screws engaging in keyhole slots. Moulded integral and plate lampholders provide retractable lampholder action and protect the ends of the channel. All attachments, including colour stable "Diakon" reflectors and diffusers, fix directly to the channel and put no strain on the lamps. The prices of the "Crompacks" range from £3 14s 5d to £7 6s including tax.

POWER SUPPLY UNIT

A power supply unit designed to provide a stable d.c. potential and so replace the use of accumulators for the tungsten lamp in the Unicam SP. 500 spectrophotometer is now available from LABGEAR, LTD., Willow Place, Cambridge. This employs a series stabiliser system with a compensating double zener reference. The use of the latest type power transistors and cast alloy heat sinks permits the unit to operate in high ambient temperatures and under adverse mains input conditions. The maximum outputs are 6 A at 6 V, 100 mA at 6 V and 100 mA at 2 V d.c., the stability factor is better than 1,000 : 1 for input variations of from −15 to +20 per cent and the ripple and noise content is approximately 3 mV peak to peak. The cost is £55.

DOUBLE OVEN COOKER

A plinth type electric cooker with two ovens, one above the other, has been introduced by the ENGLISH ELECTRIC CO., LTD., English Electric House, Strand, London, W.C.2. This new cooker, to be known as model 2034, has four 7in radiant hotplates and measures 36in high (to top of hob) by 21in wide by 25in deep. The main or lower oven has a loading of 2,600 W



English Electric model 2034 double oven cooker

and is thermostatically controlled with a range of temperatures from 150° to 550°F. It is fitted with two non-tilt reversible grid shelves, which can be adjusted to give nine different cooking positions, and there is an inner glass door. A 40 W interior light is also provided.

The top oven is 7½in high by 15½in wide by 17½in deep and is fitted with a 12½in by 8in grill with a loading of 2,000 W. This grill is simmer controlled. The grill pan has a wire rack and an aluminium plate on the bottom, which is specially designed to prevent splashing or smoking. The pan can be adjusted to three different positions. The oven is heated by top and bottom elements (total loading 800 W) and has a fixed thermostat which controls the temperature at 300°F.

The four hob-mounted 7in radiant hotplates are of the English Electric "Vee-Line" type. Each has a hinged element coil which can be lifted to an almost vertical position to facilitate cleaning. One hotplate (rear left-hand) is fitted with a spring-loaded thermostatically controlled disc. It is a device to prevent milk, etc., from boiling over by maintaining a selected temperature automatically. The selected temperature is obtained by turning a marked dial on the facia panel. Other controls on the panel, mounted on the cooker's 15in-high splashplate, include controls for the hob, grill, and two ovens and an automatic timer. Above the splashplate is a shaded 30 W tubular lamp.

The cooker is finished in white or cream—the outer door panels, hob and splashplate in vitreous enamel and the outer case and storage drawer in stoved enamel. The inside surface of both ovens is grey vitreous enamel. The cooker is mounted on two rear rollers and the price is £69.

NEW HOOVER APPLIANCES

Three new products have been introduced by HOOVER, LTD., Perivale, Greenford, Middlesex. The "Keymatic" automatic washing machine, priced at 115 gns, including tax, utilises a dual-action system of washing, combining a rotating drum with a pulsator placed within it. It accommodates 8 lb dry weight of washing and, using the hot water supply, the whole completely automatic cycle, it is claimed, can be completed in less than half an hour.

It has eight available washing programmes and, in use, having connected the machine and loaded the clothes, it is only necessary to switch on the machine and insert a key into a slot to obtain the desired washing programme. The key—or "Keyplate"—has marked on its bevelled edges the washing programmes. The "Keymatic" is a compact machine which can be stored beneath a draining board or similar space if desired—it measures 32½in high by 24½in wide by 26in deep. It is finished in blue and white stoved enamel and the tub is of porcelain enamelled steel. The loading of the heater is 3 kW.

The new "Hoovermatic" has a thermostat and time switch combined in a new control panel on the front of the machine. Besides allowing selection of the water temperature and the washing time, the dials of the thermostat/timer can be set so that the wash can be fully automatic when the correct water temperature is reached—the heater, meanwhile, automatically switching off. This machine is also fitted with a 3 kW immersion heater and is styled in white, blue and grey. It measures 31½in high by 29½in wide by 16½in deep and the price, including tax, is 85 gns.

The "Hooverette" can be used as an upright cleaner and as a hand cleaner slung from the shoulder. When used as an upright cleaner an extension tube and curved handle section are fitted at one end while a carpet and floor nozzle is fitted at the other. When assembled as a hand cleaner, in the slung position, it can conveniently deal with the cleaning of walls, fabrics, stairs, furniture, etc.

It is finished in two shades of blue and the tube fittings are anodised blue. The weight of the basic unit is 6½ lb. The price of the "Hooverette," including tax, is 13 gns.

The "Hooverette" vacuum cleaner in use as an upright cleaner

Above right: The new "Hoovermatic" combined washing machine, rinser and spin dryer

Right: Hoover "Keymatic" automatic washing machine

U.K. Electrical Trade in January

EXPORTS in January by British electrical and allied manufacturers were valued at £24·4 million. This figure compares with total United Kingdom exports of £330·1 million and £73·5 million for machinery other than electric. Electrical imports in January were valued at £4·9 million, compared with total imports of £404·3 million, and £20·3 million for machinery other than electric.

These unusually high figures indicate the difficulty of drawing conclusions from the returns for a single month. The Board of Trade says that the figures should not be taken at their face value since they may again have been inflated by goods delayed by the autumn dock strike. It suggests that the best available indication of the underlying trend is obtained by taking an average for the four months October, 1960, to January, 1961.

On this basis, electrical exports during the past four months were 4 per cent higher than in the corresponding period a year earlier after having been 5 per cent down in the third quarter of 1960. In comparison, exports of machinery other than electric in the past four months were

TABLE I.—ELECTRICAL EXPORTS

Class	Month of January 1960	Month of January 1961
	£	£
Generating sets:		
Diesel driven, not exceeding 10 kW	150,396	139,245
10 to 65 kW	187,788	166,004
65 to 200 kW	142,787	124,905
Over 200 kW	157,855	309,012
Driven by steam turbines	75,527	10,875
Driven by spark ignition engines, hydraulic turbines or other prime movers	15,162	216,522
Generators:		
Not exceeding 200 kW	124,947	94,857
Over 200 kW	50,745	69,615
Parts	1,081,983	922,681
Motors, complete, other than railway, tramway and trolley-bus:		
Not exceeding ⅓ h.p.	224,779	282,942
Over ⅓ but under 1 h.p.	60,453	100,842
1 to 250 h.p.	459,726	551,794
Exceeding 250 h.p.	214,448	119,603
Railway, tramway and trolley-bus motors, complete, and parts of all motors	191,906	286,187
Starting and controlling gear for electric motors	269,533	426,972
	3,408,035	3,822,056
Converting machinery	22,826	30,803
Mercury-arc rectifiers	49,235	61,547
Transformers for lighting, heating and power (including coils):		
Not exceeding 7,500 kVA	481,407	426,008
Over 7,500 kVA	179,315	625,748
Switchgear and switchboards (excl. telegraph and telephone):		
Switchgear up to 200 A and not exceeding 660 V	440,644	776,044
Other	1,194 269	1,291,095
	2,367,696	3,211,245
Batteries and/or cells, primary:		
For all lighting purposes	123,215	114,397
For radio	296,441	560,314
Other	42,687	47,387
Parts (excluding carbons)	47,830	69,987
Filament lamps, exceeding 28 V	102,063	99,665
Not exceeding 28 V	34,575	43,116
Fluorescent tubular lamps	59,880	83,771
All other lamps	22,836	38,734
Parts (excluding glass bulbs and carbons)	52,591	72,865
Radio and television, etc., apparatus:		
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excluding mercury-arc rectifiers), photo-electric cells (excluding photo-transistors), stabilising and cold cathode valves, magnetrons, klystrons	40,911	69,250
Cathode ray tubes	54,366	55 765
All other	369,134	519,709
Parts (excluding glass bulbs)	29,728	46,000
Broadcasting and television transmitters	93,785	88,485
Communication and navigational and radar equipment	1,596,491	2,363,008
Domestic receiving sets, mains	83,384	73,807
Battery (including complete vibrator sets)	64,127	108,628
Other (including mains/battery and radio for cars)	34,105	22,359
Radiograms	24,527	33,922
Television receiving sets	82,600	133,455
Public address equipment	99,169	84,021
Other radio and television apparatus, n.e.s.	165,966	182,422
Components and parts, n.e.s.	970,990	1,348,143
	3,709,283	5,128,974
Telegraph and telephone installations	626,970	531,416
Telephone instruments	155,169	141,197
Parts	957,967	737,341
Line apparatus for long distance communication	452,008	289,607
	2,192,114	1,699,561

Class	Month of January 1960	Month of January 1961
	£	£
Cookers	38,205	51,736
All other cooking appliances	55,499	66,517
Parts and accessories	113,403	98,551
Space heating appliances	26,333	28,917
Water heating appliances	29,806	42,954
Other heating appliances	25,430	34,982
Parts and accessories	96,600	126,390
Irons	95,157	84,464
Arc welding equipment, a.c.	42,667	56,748
D.c.	53,903	44,752
Resistance welding	23,317	100,267
Electric furnace plant	83,778	87,154
Sparking plugs	211,102	168,949
Electrical appliances for aircraft	299,443	245,025
For motor vehicles	590,371	681,237
For cycles	37,720	41,295
Signalling apparatus (incl. traffic signals)	153,020	142,558
Instruments, commercial	156,973	251,219
House service meters (electrical) including parts	201,545	204,975
Electro-medical apparatus (excluding deaf-aids and X-ray apparatus and batteries)	50,684	43,722
X-ray apparatus (excluding tubes and valves)	68,110	51,617
Ceiling fans	91,268	114,012
Desk fans, and parts of desk and ceiling fans	25,390	57,215
Vacuum cleaners	154,425	234,329
Floor polishers	90,426	78,010
Food mixers	45,551	61,072
Hair clippers and dry shavers	79,210	127,824
Other portable appliances	21,881	55,966
Parts	184,197	199,806
Portable elec. tools, incl. parts	241,319	288,346
Telegraph and telephone cables and wires:		
Submarine	1,180,501	26,451
Other	476,142	284,946
Other descriptions:		
Cotton, silk or man-made fibres insulated	21,190	29,097
Enamel, glass or asbestos insulated	125,086	136,438
Paper insulated	646,270	651,578
Rubber insulated	278,900	345,258
Thermoplastic insulated	324,958	353,326
Other	183,091	274,105
	3,236,138	2,101,199
Accumulators for motor vehicles	133,117	143,968
For radio and other portable	27,867	40,423
All other accumulators	42,547	106,550
Parts and accessories	82,347	146,527
Electric wiring accessories	203,835	262,132
Electrical ware (including insulators) of ceramic materials, n.e.s.	130,425	124,736
Industrial electronic control equipment	158,791	202,817
Insulators and insulating materials, n.e.s.:		
Cloth and tape	57,473	70,540
All other	190,367	144,574
Permanent magnets	53,251	69,895
Radio, telegraph and telephone testing equipment, n.e.s.	150,553	165,070
Scientific electrical instruments (excluding telegraphic and telephonic; time recorders and time switches)	434,601	578,406
All electric machinery, apparatus and appliances, n.e.s.:		
Machinery	21,161	63,091
Other	942,757	1,362,589
TOTAL	21,711,209	24,445,198

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE 1)

Country	Month of January 1960	1961
	£	£
Gibraltar	15,624	17,831
Malta	57,300	62,509
Cyprus	108,456	76,405
Sierra Leone	59,422	95,031
Ghana	255,019	321,130
Nigeria	627,887	537,319
Union of South Africa	1,381,132	1,717,243
Rhodesia and Nyasaland	669,965	751,835
Tanganyika	65,544	71,678
Kenya	161,850	181,067
Uganda	30,703	49,644
Mauritius	59,624	32,016
Aden	41,232	103,602
Bahrain, Qatar and Trucial States	100,723	140,086
Kuwait	226,826	311,339
India	1,375,842	1,145,289
Pakistan	340,454	438,083
Singapore	193,272	279,677
Federation of Malaya	142,287	287,795
Ceylon	147,622	191,836
British North Borneo	16,888	39,108
Sarawak	8,943	9,074
Hong Kong	489,113	500,266
Australia	1,601,340	2,167,643
New Zealand	929,011	982,882
Fiji	18,302	51,524
Canada	1,373,623	1,290,684
Bermuda	28,504	32,434
Bahamas	37,050	37,876
Jamaica	175,298	198,391
Barbados	34,562	45,346
Trinidad	225,413	166,348
British Guiana	102,332	59,031
Other Commonwealth countries	107,362	103,530
Irish Republic	416,191	514,752
Soviet Union	263,712	175,736
Finland	146,612	159,580
Sweden	457,584	625,830
Norway	223,545	358,002
Denmark	208,874	274,419
Poland	128,521	70,236
Western Germany	575,020	639,880
Netherlands	599,086	846,580
Belgium	234,637	288,016
France	320,049	502,777
Switzerland	168,976	142,631
Portugal	417,914	195,870
Spain	203,611	447,338
Italy	313,636	496,962
Austria	43,331	100,059
Yugoslavia	112,446	218,890
Greece	144,158	194,868
Turkey	57,378	132,720
Portuguese East Africa	50,766	30,100
Egypt	139,034	114,470
Libya	60,795	86,157
Morocco (including Tangier)	22,243	31,443
Congo Republic	49,854	28,192
Sudan	93,670	256,009
Syria	39,725	87,384
Lebanon	90,976	83,180
Israel	97,322	165,848
Jordan	123,340	119,261
Saudi Arabia	37,779	96,876
Iraq	181,665	454,122
Iran	318,187	397 640
Burma	25,898	58,191
Thailand	42,131	69,781
Indonesia	73,803	559,637
China	168,718	100,712
Japan	65,878	66,455
United States of America	2,307,242	776,615
Cuba	40,361	4,179
Mexico	120,540	273,832
Columbia	32,112	33,748
Venezuela	302,121	205,569
Peru	22,746	49,871
Chile	123,187	103,500
Brazil	49,380	105,722
Uruguay	29,998	12,135
Argentine Republic	353,910	498,841
Other foreign countries	404,022	695,030
TOTAL	21,711,209	24,445,198

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month ended 31st January 1960	1961
	£	£
Australia	26,413	158,210
Canada	93,330	186,090
Other Commonwealth countries	187,893	216,293
Irish Republic	83,521	130,162
Sweden	86,671	222,941
Denmark	57,716	124,640
Western Germany	787,235	799,842
Netherlands	532,910	595,035
Belgium	41,559	57,953
France	158,598	231,488
Switzerland	136,236	242,133
Italy	117,799	117,352
United States of America	1,252,346	1,491,724
Other foreign countries	196,887	311,702
TOTAL	3,759,114	4,885,565

10 per cent higher than a year earlier after having been 11 per cent up in the third quarter of 1960. On the same basis, electrical imports were 30 per cent up on last year during the four months October to January after having been 30 per cent up during the third quarter of 1960.

In January, the main markets for electrical exports were Australia (£2·2 million), South Africa (£1·7 million), Canada (£1·3 million) and India (£1·1 million) and with the exception of India each total was higher than in January, 1960. Exports to Europe were also well up on a year ago. All the main groups except telegraph and telephone equipment and cables and wires showed a higher total than a year ago.

Volume and Prices in 1960

The volume index for exports of electrical machinery, apparatus and appliances in 1960 is calculated by the Board of Trade as 126 (1954=100) compared with 124 in 1959 and 127 in 1957. The index for all manufactured goods, which rose to the highest level yet recorded for this group, was 124 compared with 117 in 1959. The price index for exports of engineering products, after falling three points to 98 in 1959, rose last year to 102.

The volume index for electrical imports rose from 202 in 1959 to 238 last year, compared with a rise of 51 points to 201 in the 1960 index for imports of all manufactured goods.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month ended 31st January 1960	1961
	£	£
Washers and dryers, domestic, electrically operated: Complete:		
Washers incorporating centrifugal water extraction	80,548	409,533
Other, with or without wringers	542,984	263,695
Dryers (exported as separate units)	66,391	26,856
Parts	115,226	136,495
Electric locomotives (incl. battery types)	307,489	567,163
Diesel locomotives with electric transmission	102,593	173,600
Welding electrodes:		
Ferrous	119,700	1 403,297
Non-ferrous	22,414	26,968
Electric conduit tubes and cased tubes	78,543	111,086
Electric carbons	117,246	145.023
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	350,053	375,467
Electric fork-lift trucks	91,153	253,700
Water and gas turbines, etc.	593,491	696,034
Steam turbines	1,373,184	512,518

TABLE 5.—ELECTRICAL IMPORTS

Class	Month ended 31st January 1960	1961
	£	£
Generators, incl. parts	56,815	111,116
Motors, incl. parts	142,786	252,825
Convertors; transformers; rectifiers	112,582	196,204
Switchgear and switchboards (not telegraph and telephone)	160,209	219,571
Bulbs, arc lamps and tubes for electric lighting, complete	93,852	117,388
Cathode ray tubes, complete	22,544	30,077
Transistors (incl. photo-transistors), complete	106,801	74,283
Other, complete	195,657	248,771
Parts (excl. glass bulbs)	226,008	100 683
Radio receiving sets, domestic or portable	28,271	56,832
Radio communication and navigational aids, complete	402,737	449,612
Other radio and TV apparatus, parts and accessories	286,184	517,264
Apparatus for telegraphy and telephony	51,195	74,802
Welding machinery	65,033	95,584
Cooking and heating apparatus	124,899	202,348
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	320,010	282,388
Instruments, commercial	83,063	123,085
Electro-medical apparatus (incl. X-ray apparatus)	99,207	122,017
Portable mechanical appliances electrically operated, complete	108,025	101,434
Parts	66,805	84,078
Industrial electronic control equipment	44,805	128,424
Scientific electrical instruments (excl. telegraphic and telephonic)	147,908	160,868
Other machinery, apparatus and appliances	813,718	1,135,911
TOTAL	3,759,114	4,885,565

Plant Operation in Hazardous Areas

By W. J. F. COCKS, A.M.I.E.E., A.F.Inst.Pet.

Author's summary of a lecture entitled "Operation of Electrical Plant in Hazardous Areas" which was delivered at a meeting of the Association of Supervising Electrical Engineers on 21st February

A REVIEW of the regulations relating to the operation of electrical plant in hazardous areas raises a number of interesting problems that can be studied in the modern petroleum installation, where far-reaching developments have taken place within the last few years which may affect marketing operations within the oil industry and possibly other industries.

To comply with the regulations within the United Kingdom the following types of plant and methods are used in the petroleum installation:—

(a) Flameproof electrical apparatus which has been certified by the Ministry of Power for use in the particular flammable atmosphere.

(b) Intrinsically safe equipment which has been certified by the Ministry of Labour for the particular application.

(c) Pressurisation and air purging.

(d) Ventilation.

(e) Segregation of plant to ensure that electrical apparatus is situated in an area free from a dangerous atmosphere.

The design of a flameproof enclosure for electrical apparatus accepts the fact that connecting up and maintenance in the field makes it unlikely that any gaps between the removable covers and main case of the equipment will be gastight. Flanges are provided, usually 1in wide and of a specified maximum gap dimension depending upon the flammable gas. This will ensure that any flame resulting from an internal explosion is cooled by its passage through the narrow flange gaps and will not ignite any external gas which may be present in the surrounding area.

A great deal of flameproof equipment has had to be erected in the open. The performance was very satisfactory over a number of years, but in view of the type of construction where gaps are employed, there is always the possibility of electrical failures resulting from ingress of water, condensation and the chance that corrosive gases may be drawn into the equipment during daily heat cycles in normal operation.

Over the last few years flameproof-weatherproof equipment has been introduced and in this equipment a socket and spigot joint has been incorporated to keep out moisture, but the flanges with the safe gaps have been retained. The method has been limited to small enclosures, but experiments have been undertaken to determine whether the introduction of gaskets between the machined faces of flameproof enclosures would solve the problem, providing that the gasket material would perform satisfactorily under all conditions. The results of the experiments are most

The main input console of a direct order recording and invoicing system

encouraging. Field trials are now in hand to check the gaskets' long-term performance.

For an intrinsically safe circuit to meet the requirements as defined in B.S. 1259 a number of factors must be taken into consideration in the design and these include supply voltage, resistance, capacitance, inductance, and where thermionic valves are employed resistors must be included in anode circuits to limit fault currents to a safe value.

While it is not at present possible to obtain a certified flameproof enclosure for use in a hydrogen atmosphere, a certified intrinsically safe circuit can be obtained for use in these conditions.

Intrinsically safe apparatus finds a ready application in control circuits, instrumentation, communications, portable hand lamps and certain developments in automation. The apparatus has economical advantage over a flameproof enclosure for certain applications, it can be made fully weatherproof and its great advantage is that no special precautions are necessary for its installation in a hazardous area.

Pumping Equipment

In a typical modern depot there are 18 to 20 centrifugal pumps erected on an open main pump platform which transfer the petroleum product from main storage tanks to the road wagon filling gantries, and the motor horsepowers range from $7\frac{1}{2}$ to 30. The motors in a large oil installation, with a product storage of 275,000 tons and an annual throughput approaching 1,000,000 tons, may be up to 200 h.p. Flameproof starters are frequently erected near to the pump motors and as most electricity authorities place a limitation on starting current star-delta starting is employed and facilities for remote control from flameproof pushbutton pilot lamp stations on road wagon filling gantries are provided.

To simplify controls for vehicle loading where multi-speed pumps are used, possibly with reversal of motor rotation for line clearing, data and control multiplex equipment has been introduced which is of intrinsically safe design suitable for use in a hazardous area and, of course, can be of weatherproof construction.

Where fuel oil pumps feed the common road wagon filling gantry all associated controls must be either intrinsically safe or of flameproof construction and this includes flow-sensing devices recently introduced with certain modern positive displacement pumps for heavy oils.

Tank Level Gauging

There are a number of methods which are frequently employed for transmitting details of product level in a storage tank to a central control room. One method uses a displacer suspended by a stainless steel wire which passes up through an opening in the tank roof to a winding drum situated within an enclosure on the roof. The principle of operation is that part of the displacer weight is supported by the weight of liquid displaced and the remainder by a helical spring. One end of the spring is attached to an arm rigidly fixed to the spindle of the winding drum, and the other end to a disc which carries two contacts. A change in liquid level causes the contact on the arm to touch either of two contacts on the disc and this operates a reversible two-phase induction motor, which causes the disc to follow the movement of the winding drum until the centre contact is in the neutral position and breaks the circuit to the motor.

To obtain remote indication, a transmitting element is used which consists of a rotary switch having five brushes, two of which receive a 50 V d.c. supply; the other three brushes are connected to three windings in the stator of a small motor in the receiver unit on the remote instrumentation panel. Rotation of the transmitter causes a change in the polarity of the brushes which results in a rotation of the magnetic field in the stator of the receiver unit motor, so that its permanent magnet armature rotates in synchronism with the transmitter.

Another method employs a servo controlled sensing head which does not touch the liquid in the tank, but remains a small distance away from it. A capacitance will exist between the shielded electrode plate within the sensing head and the liquid surface and this capacitance is made part of a bridge circuit fed from a local transistorised oscillator. Any change in level alters the electrode plate/liquid level capacitance and the resulting out-of-balance current causes the servo motor to drive the sensing head upwards or downwards to restore the capacitance to its original value, and as the local reading counter is also driven from the servo motor, possibly via a perforated tape, a new liquid level is indicated. Remote indication is obtained by mechanical scanning of a gear wheel system which is driven by a perforated tape and groups of pulses representing tank identification and level are transmitted to a receiver panel, presentation on which is given by neon numerical tubes.

All electrical equipment in the first method is of flameproof construction. In the second method the electrical circuits between the servo control unit and sensing head are intrinsically safe. The remaining equipment is flameproof.

The Modern Depot

Flameproof precise level gauging and intrinsically safe temperature measuring equipment is erected on each storage tank and the information is transmitted to a central console in the office building. The console may incorporate pushbutton control for all valves in the tank compounds, and any controls and instrumentation associated with a pipeline should the depot be fed in this manner.

In July, 1960, a direct order recording and invoicing system known, for short as "DORIS," was installed at the Royston installation, and this equipment deals with all accountancy from receipt of customers' orders by telephone to the preparation of vehicle loading instructions. The introduction of business machines into the petroleum depot may have far-reaching developments and future equipment operating over land lines or micro-wave links in conjunction with a central computer which can give instructions for the controlled loading of vehicles may show considerable saving in operating costs.

Non-Ferrous Metals in 1960

The British Metal Corporation, Ltd., 93, Gresham Street, London, E.C.2, has published its annual review of non-ferrous metals covering 1960. This contains graphs showing the course of prices of copper, lead, zinc and tin during the year and gives tables and data relating to production and consumption.

E.D.A. SALES CONFERENCE

Summaries of Papers Discussed at Harrogate

SOME 400 delegates from the Area Electricity Boards have this week been attending the 24th Annual Sales Conference of the Electrical Development Association at the Royal Hall, Harrogate. The Conference was formally opened on Tuesday morning with an address by Mr. David Irving (chairman, E.D.A. Council, and chairman of the London Board). This was followed by an address by Mr. J. I. Bernard (director of E.D.A.), who reviewed the Association's activities in 1960-61 and outlined future advertising campaigns.

Display Techniques

At the afternoon session, with Mr. Irving in the chair, Mr. C. Nield (Midlands Board) read a paper on " Presentation of Merchandise in Service Centres " in which he dealt with the principles of display, interior presentation, lighting, the display department and training.

Display space, he said, whether in a window or in a showroom interior, was possibly the Board's cheapest advertising space and it should be made to produce the maximum effect. The increase in the market for electrical appliances was reflected in the growth of additional retail outlets now handling electrical merchandise. For the Boards to obtain and retain their share of the market, attention must be paid to all factors which increased sales. Presentation, particularly in the window, was often the first factor in the chain of events from first interesting a prospect, to the ultimate purchase. The author then went on to deal with service centre layouts and offered many useful suggestions that would not only brighten up the showroom but also increase sales.

Brief on-the-spot demonstrations of appliances such as washing machines, dryers, dish-washers, cookers, etc., could be worth while, he said, but he warned that too many at one time could produce an adverse effect and give customers a sense of running the gauntlet. The function of display lighting, said Mr. Nield, was to enhance the appearance of the merchandise and it should play its part in attracting the attention of the passer-by and casual shopper. The display of lighting fittings was a special problem and it was generally agreed that these were better displayed by being grouped together and suspended from a false ceiling, lower than the rest of the showroom ceiling. He then spoke of the advantages of the Boards having a good central display department.

Co-operation Between Boards and Manufacturers

" The success of the domestic electrical appliance business, whether in terms of manufacturing and retailing prospects or useful load building, depends more than ever before on vigorous, enlightened and unremitting salesmanship." This was stated by Mr. Stanley F. Steward, C.B.E. (director of B.E.A.M.A.) on Wednesday morning in his paper " The Future for Domestic Electrical Appliances." Mr. R. R. B. Brown (chairman, Southern Electricity Board) was in the chair. A large part of Mr. Steward's paper consisted of a summary of current trends in important appliances contributed by the various B.E.A.M.A. sections.

Dealing with the more general factors affecting the future of domestic appliance business, Mr. Steward pointed to the rise (44 per cent since 1948) in the number of domestic consumers and the growing number of married women employed in industry and commerce. This important social trend had helped to create a powerful new market not only by increasing the means to purchase but also by accentuating the need. Purchases of domestic electrical appliances by the largest social-economic group in the country (ten million wage-earning families) were expanding at a more rapid rate than those by other sections of the community.

Linked with this changing social pattern was the trend towards smaller dwellings and kitchens. Though they might deplore this, they must ensure that the design of appliances kept pace with modern needs. This might well call for modular construction with more standardisation and more enlightened co-operation from architects and builders.

Automation in the home had quickly caught the imagination, but Mr. Steward pointed to evidence that automatic features on appliances were not always used to full advantage. This was a field which offered great scope for education and propaganda.

The safety and reliability of domestic electrical appliances were matters on which there was much common ground between the manufacturers, distributors and the supply industry. The operation of the new approvals scheme was well under way and the need now was to make the approvals mark* widely known and accepted with confidence by the public as a hallmark of safety and reliability. Until such time as the scheme had statutory enforcement its effectiveness would depend on the backing and publicity given by all sections of the electrical industry.

Mr. Steward said that in addition to the weight of evidence given elsewhere in his paper, there were three factors that gave every reason for optimism about the long-term demand trend for appliances. The first was the steady rise in consumer spending on appliances, which in the past ten years had been three times faster than total consumer spending. Second was the scope for sales revealed by the saturation figures and the fact that ownership of certain appliances was not restricted to one per household. The third factor was the ever-widening range of appliances available. The growing market would attract new producers and increased imports, and competition in price, performance and service would become more intense.

Much thought would have to be given to the economics of distribution and to the provision of good nation-wide technical service, but the main contribution would have to

*The new mark is reproduced on page 385.

come from the standards of design and the efficiency of production. Experience showed that credit restrictions had little or no effect on the long-term growth of demand for appliances. But B.E.A.M.A. had sought Government recognition of the increasingly important part played by the " growth " industries in the national economy and the need for stability in credit controls to ensure efficient production and competitiveness in overseas markets. Plans to cater for this expanding demand also required a scientific approach to marketing. The product designer must be adequately briefed, as a result of thorough investigation into the changing pattern of consumer requirements, and his brief must include the range of acceptable prices.

Mr. Steward said he believed that to exploit to the full the opportunities before the industry there should be a really frank, constructive and uninhibited partnership between the supply industry and the manufacturers in all matters of sales promotion in the domestic field.

The whole industry would benefit greatly from improved statistics. With the backing and co-operation of the whole industry it should be possible for B.E.A.M.A. to compile quickly information on production, sales and stocks of appliances; information which would prove of great value not only in guiding production plans and selling arrangements but also in helping B.E.A.M.A. to ensure that the Government was better informed about the state of trade in the industry.

Finally, on the opportunities for joint working between different sections of the industry, Mr. Steward said that what was needed was better machinery to enable the sales and promotional efforts of all parties concerned with the development of the domestic electrical market to be directed towards a common aim and to be designed to give full support to each other.

Adequate Installations

A domestic installation remains adequate only so long as the consumer can continue to purchase electrical appliances which can be used safely in the places required—without having to meet extra expense for additional circuits. This was one of the points made by Mr. W. F. Jarvis (North Western Board) when presenting his paper " More Adequate Wiring " at Wednesday afternoon's session. Mr. D. Bellamy (chairman, Yorkshire Board) presided.

The speaker first dealt with wiring developments up to 1939. In 1929, he said, there was a total of 3,472,000 electricity consumers and the figure increased steadily until, at the outbreak of the war in 1939, there were over 10½ million. The majority of the homes were equipped for lighting only and had been wired under assisted wiring schemes, popular in the early 1930's. Councils could not foresee electrical domestic development beyond lighting and the odd appliance, such as the electric iron, and many municipal estates were limited to an installed load of 2 kW per dwelling. Thus, by 1939, Mr. Jarvis observed, many electrical appliances had become established, and four lighting points and a single 5 or 15 A socket-outlet had long since become inadequate.

The problem of adequate wiring in post-war homes received official attention when, in 1942, the I.E.E. Council convened a committee to review existing information and practice concerning installations in buildings. In 1944 the committee's findings were published and the main features of the report were further developed by E.D.A., the I.E.E., the British Standards Institution and certain installation accessories manufacturers.

The I.E.E. Wiring Rules Committee published a supplement in 1946 which introduced circuits for paralleling a number of socket-outlets or the connection of socket-outlets in a ring main system. A year later B.S. 1363, ring main plug-socket-outlets for appliances up to 3 kW, became available. This socket-outlet offered complete interchangeability.

Mr. Jarvis then dealt with the implementation of the 1942-47 recommendations and mentioned the strong competition from other fuel interests that electricity undertakings encountered at that time. It was, he said, in this somewhat uneasy atmosphere that the electricity supply industry was nationalised but, unfortunately, in the early years of nationalisation there were more pressing and urgent problems than house wiring to be solved.

It was not until 1958, said the author, that any concerted effort appeared to have been made public, when at the British Electrical Power Convention it was announced that later that year all sections of the electrical industry were to combine to launch a campaign for wiring installations adequate to meet the needs of electrical living.

Dealing with future considerations, Mr. Jarvis said that the main problem was to make sure that all installations would meet the requirements of existing apparatus, and other appliances yet to be designed and marketed over the next two decades. He questioned how long the 60 A main surface fuse and cut-out would remain adequate and whether consumer service units should not be revised to include one or more 45 A fuse ways so that it could be partly used as a section fuse-board. The 3 kW loading, so long accepted as a maximum for most portable domestic appliances, would most certainly be exceeded in the future.

Mr. Jarvis went on to remind the audience that B.S. 546 already included a 30 A socket-outlet and that Mr. T. E. Daniel forecast in his 1960 B.E.P.C. paper that it might be wise to make plans for water heaters with loads of 5 kW, and to be considering the appropriate way of connecting them.

Ways and means must now be considered of bringing old installations up to date. This was a most difficult and thorny problem, said Mr. Jarvis, and throughout the country Electricity Boards were selling an average of 6,960 cookers per week, many of which required a new installation. It should, he said, be possible to sell the idea to consumers that for a small charge a circuit with increased capacity capable of supplying a cooker, plus a number of socket-outlets for other appliances, could be installed.

In conclusion, Mr. Jarvis said that in order to obtain greater success in their efforts for all houses to have more adequate wiring to meet the needs of electrical living, all sections of the electrical industry would have to combine to launch a suitable campaign which must include long-term easy payment facilities.

Control of Off-Peak Heating

On Thursday morning, with Mr. D. H. Kendon (chairman, Merseyside and North Wales Board) in the chair, a paper on " The Control of Off-Peak Floor Warming in Domestic Premises " was read by Mr. A. F. Hardcastle, M.I.E.E. (Southern Board).

Off-peak electric floor warming, he said, was perhaps the most important domestic load development that the

industry had dealt with since the introduction of the electric cooker. The position where central heating was regarded as a luxury was changing, in some areas rapidly. Electric floor warming was more economical to install in multi-storey blocks of flats than other methods of heating, but so often the saving in capital cost had not been utilised to provide a better thermally insulated building. If the heating was under a landlord's control, the author said that he had found that the landlord, generally the local authority, needed little convincing that a little extra money spent on improving the thermal qualities of the building would pay dividends.

Since there was no doubt that off-peak supplies would substantially increase in the future, the method of control to be adopted should be decided when planning distribution systems. The author expressed himself strongly in favour of the pilot wire system, which he said was the cheapest form of control in general distribution networks when ten or more consumers were likely to take an off-peak supply. Where such a demand could be anticipated, a pilot wire should be provided when laying new mains and services.

When planning electric floor warming installations in multi-storey buildings it was important, Mr. Hardcastle said, to reach early agreement on whether the installation was to be under the tenant's or landlord's control. An advantage of the first system was that the tenant could adjust the temperature to his own requirements and effect some saving by switching off the installation when the flat was empty. Experience had shown, however, that this could lead to an undesirable peak use of electric fires. With the second system, all the tenants received the correct amount of heat for which the installation was designed. This was the only satisfactory way of ensuring that all the installations were used. There was no temptation for some tenants to switch off their floor warming and draw heat from adjoining flats. There were no condensation problems with tenants' furniture, decorations or the building fabric.

If the local authority wished to make arrangements for their tenants to have freedom to change from one method of control to another then all the flats must be satisfactorily heat insulated from each other. Mr. Hardcastle said it was not possible to completely restrict the downward heat loss between flats, but if sufficient insulation was applied to the under-side slab so that downward loss did not exceed 10 per cent to 15 per cent, it might be considered commercially acceptable. Nevertheless, this would considerably increase the weight and height of the building and thus its capital cost.

With the landlord's operation, the approximate cost of off-peak floor warming during a 30-week heating season in a 2/3-bedroom council flat, when designed to give 65°F in the living room and 55°F in the hall and kitchen, varied between 8s 6d and 11s 9d per week according to the size of the flat and the tariff charged when the rent was spread over the year. Experience had shown that 10s per week was approaching the limit the average council tenant cared to pay in his rent for a heating service.

The cost was reduced by approximately 5 per cent for every degree reduction in temperature between 65 and 55°F. Therefore, if the rental for the heating service was 10s, a reduction in the temperature from 65 to 55°F would save approximately 5s per week. With this 5s per week, Mr. Hardcastle suggested, the tenant could pay for whatever supplementary heating he might require.

In the author's opinion, thermo-time regulators provided the best method of control as they were unaffected by changes in the room temperature and each tenant would receive the amount of heat for which he paid. Protection against the failure of the regulator and the possibility of overheating the floor could be achieved by a master thermostat for the whole block.

Small Industrial Consumers

The final paper, on Thursday afternoon, dealt with "The Board and the Small Industrial Consumer." The author was Mr. A. Ellison (North Eastern Board) and Mr. T. E. Daniel (chairman, North Western Board) presided.

A small industrial consumer was considered to be one having a maximum demand of less than 100 kW, said Mr. Ellison. In the North Eastern Board's Area there were 8,300 industrial consumers and of those 6,035 were the small industrial kind. In the Tees Sub-Area there were 1,391 small industrial consumers and of those 93 per cent had a maximum demand below 40 kW. The majority worked a 44-hour week, hence the individual annual load factor was, generally speaking, less than 20 per cent.

Mr. Ellison went on to outline the small industrial consumer's requirements and said that the majority considered reliability much more important than the cost of electricity. A small factory could lose between £60 and £100 hourly due to supply failure. When discussing the economics of supply, he said, it was advisable to stress that it was not necessarily a question of how little electricity one could use or how little it would cost, but rather how one could get the best value from its use. The cost of electricity for the average industrial consumer with normal load factor was a very small proportion of the total production costs and, even for the small industrial consumer, seldom exceeded 5 per cent.

The steady rise in the cost of labour and materials and the question of whether the Boards should try and keep the cost of electricity as low as possible in order to compete with other fuels had focused attention on contributions towards the cost of new or increased supplies. Assessing a fair contribution was difficult, he said. A particularly embarrassing situation arose where a consumer decided to increase his load from 70 kW to 100 kW and then was told he would have to provide accommodation for a substation. Perhaps, said the author, since electricity costs were a very small percentage of production costs, consumers would prefer slightly increased standard tariffs and no contributions for permanent additional loads and new supplies. Speaking of the scope for development, he said that new factories, offices, etc., offered excellent opportunities for electric floor warming and there was tremendous scope for improved lighting in small workshops. Air conditioning was also receiving more attention than hitherto. The question of offering supplies to new trading estates was one which might be given further consideration. Some Area Boards did not ask for a contribution, but required a guaranteed minimum revenue for a number of years. Others ask for a substantial contribution. The question might well be asked, said Mr. Ellison, "Should the cost of supplying these trading estates be looked upon as a social obligation in the same way as the Boards have undertaken to afford rural supplies?"

Financial Section

STOCKS and SHARES

BETTER news from the motor-car industry has been one of the factors contributing to the maintenance of firm and active conditions in the industrial markets of the Stock Exchange. Prices have again reached a level at which yields on the most popular of the progressive shares are down to the range of 3 to 4 per cent. Comparison with the yield bases of 6½ to over 7 per cent on which this week's big offers of steel companies' debenture and preference stocks were made indicates the extent to which the equity maintains its ascendancy over the fixed-interest security in the investor's favour.

Electrical Shares

Improvements in electrical share prices over the week were well spread and sometimes substantial. Among the shares of the major groups, there was an improvement of 1s 6d in A.E.I., on which the final dividend declaration will be due shortly. Crompton Parkinson continued to be notably well supported, up to 12s 9d. English Electric hardened to 33s 9d on further consideration of the annual results, assisted by news of the £34 million orders placed by the Central Electricity Generating Board in connection with the projected West Burton power station, in which the International Combustion and Simon-Carves group also participates. Shares of the last-named companies appreciated, as did some other engineering shares including Babcock & Wilcox, Head Wrightson and Metal Industries.

Consumer Goods

Recovery in the shares of radio and television manufacturers made further headway, with Decca again prominent: a further gain of 1s 6d took the price of the " A " shares to a new peak of 60s. There were sizeable gains too in Ultra Electric, E.M.I. and Thorn Electrical. In the motor accessories sections, electric battery issues were outstanding. Chloride Electrical added 2s 6d to the previous fortnight's advance of 10s, reaching 86s 3d; Lucas were advanced by 1s 9d to 65s 6d and Oldham & Son by 3d to 3s. Hoover moved up 2s to 49s 3d under the influence of the recently published annual results, while Dimplex and Berry's Electric were buoyant as ever. Dealings in Clifford & Snell 1s shares were expected to start yesterday (Thursday).

Ether Langham Thompson

A rise in the price of Ether Langham Thompson 5s shares from about 26s to 31s 3d signalled market reactions to the company's preliminary statement on the results for the year ended last September. The total dividend of 20 per cent for this period is 5 per cent above last year's, and 2½ per cent more

Price Changes in

Company or Board	Nom. Value	Middle price 27th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1960 Highest	1960 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	75		3	3	4 0 0	79½	74
Brit. Elec. 1974/77	100	70	+⅛	3	3	4 5 9	76	69
Brit. Elec. 1976/79	100	73	+⅛	3⅛	3⅛	4 16 0	79⅛	72⅛
Brit. Elec. 1974/79	100	80½		4¼	4¼	5 5 6	90½	81
Brit. Elec. 1967/69	100	91	+⅛	4⅛	4⅛	4 19 0	97⅛	90
Overseas Electric Supply								
Calcutta Elec.	£1	21/-		7†	7⅛†	11 14 0	21/-	19/3
East African Power	£1	14/-	—1/-	8	10	14 5 6	20/3	13/-
Nigerian Elec.	£1	18/-		8	10	11 2 6	19/9	15/6
Perak Hydro-Elec.	£1	18/-		10	10	11 2 0	21/-	15/3
Electrical Shares								
Aberdare Holdings	5/-	15/3	+3d	17½	17½	5 14 9	19/-	14/6
Aerialite	1/-	7/-		54	54	7 14 3	9/6	6/3
Allen, W. H.	£1	38/9		14	10*‡	5 3 3	43/9	34/6
Allied Insulators	5/-	9/9	+3d	—	20	5 2 6*	11/6	9/-
Alwyn Holdings	5/-	26/3		—	12½	2 7 6	30/6	17/9
Anglo-Portuguese Tel.	£1	21/-	—9d	9	9	8 11 6	29/-	22/6
Arcolectric	1/-	4/-		15	15	3 15 0	5/6	3/9
Aron Meters	£1	68/-		15	15	4 8 3	90/-	47/-
Assoc. Elec. Ind. Ord.	£1	42/3	+1/6	15	15	7 2 0	66/6	39/6
Automatic Tel. & El.	5/-	17/-	+6d	17	17	5 0 0	21/9	14/6
Babcock & Wilcox	£1	33/9	+2/-	13	9	5 6 9	48/9	32/6
Bakelite	10/-	50/-	+1/3	15	17½	2 18 6*	52/-	33/6
Baldwin, H. J.	2/-	1/6		20	—	—	2/6	1/9
Berry's Electric	5/-	43/-	+3/-	30	30*‡	3 9 9	38/6	22/3
Bowthorpe Holdings	2/-	8/6		27	18½*	4 7 0	11/6	7/9
Brit. Elec. Resistance	2/-	6/9		17½	17½*‡	5 3 9	8/3	4/6
Brit. Elec. Traction: Def. Ord. " A "	5/-	50/-	+6d	35	40	4 0 0	49/3	42/-
Brit. Electronic Ind.	5/-	13/6	+6d	—	15‡	5 11 0	—	—
B.I. Callender's	£1	56/-	—3d	13½	13½	4 16 6	61/-	47/9
B.I. Callender's 6% Pref.	£1	18/-		6	6	6 13 3	21/-	18/6
British Thermostat	5/-	40/-	+2/6	35	20*	2 10 0	32/6	21/3
Brook Motors	10/-	49/-		25	25*	5 2 0	53/6	43/9
Bulgin, A. F.	1/-	9/3		50	55	3 19 0*	10/3	8/-
Bulpitts	5/-	18/-		15	16¼	4 10 3	23/3	16/6
Burco Dean	5/-	9/6		18	15	7 18 0	15/9	8/9
Cable & Wireless	5/-	19/3	+3d	10	10*	2 12 0	18/3	14/3
Cambridge Instruments	5/-	33/9		11¼†	12½†	3 0 9	33/-	24/9
Chloride El. Storage " A "	£1	86/3	+2/6	20	17½*	4 1 3	81/-	65/6
Clarke Chapman	£1	45/-		13¾	13¾	6 2 3	63/9	45/-
Combined Elec. Mfrs.	4/-	7/9		—	12½‡	6 9 0	8/6	8/-
Contactor Switchgear	5/-	15/-	+6d	14	14	4 13 3	17/9	14/6
Cossor, A. C.	5/-	7/-	+3d	5	Nil	—	10/-	5/-
Crabtree	10/-	31/-	—3d	20	12½*	4 0 9	39/6	24/-
Crompton Parkinson	5/-	12/9	+3d	14	12½*	4 18 0	15/-	10/9
Davis & Timmins	5/-	35/3	+1/9	20*	30‡	4 5 0	35/-	17/-
De La Rue	10/-	61/3	+1/3	22½	22½‡	3 13 3	78/6	47/9
Decca " A "	10/-	60/-	+1/6	20	23⅓	3 17 9	51/3	40/9
Desoutter	5/-	51/3		21⅝	30	2 18 6	50/-	37/6
Dewhurst	2/-	9/6	+6d	20	20	4 4 3	8/6	7/-
Dictograph Tel.	2/-	11/6	+6d	20	20*	3 9 6	9/9	7/9
Dimplex	5/-	65/-	+2/-	—	30	1 18 6*	48/-	22/6
Dubilier Condenser	1/-	2/9	+3d	25	30	5 9 0*	3/3	2/3
Duport	5/-	14/6		17½	20	4 12 0*	20/-	12/9
E.M.I.	10/-	46/3	+3/3	20	17½*	3 16 6	58/9	41/9
Eleco	2/-	6/6	+1/-	20	20	3 1 6*	4/6	2/6
Electrical Apparatus	5/-	17/6		14½	20	5 14 3	18/3	12/9
Electrical Components	5/-	9/3		15	11½*	6 4 3	13/9	9/6
Elec. Construction	£1	33/6	—9d	9	9	5 7 6	43/-	31/3
Elliott-Automation	5/-	29/-	+3d	9·3	12‡	2 1 6	36/-	19/9
Enfield Rolling Mills	£1	45/6	—6d	15	15	6 11 9	56/-	45/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

than the rate forecast at the time of the Ether company's acquisition of the J. Langham Thompson group last October. This new member and its subsidiaries contributed £125,000 to the results, from the date of the acquisition. The original group's earnings expanded by a full 50 per cent to £153,000, making an aggregate of £278,000, which gives more than 2½ times cover for the dividend distribution. A 60 per cent scrip issue is proposed, and this would be another factor in the valuation of the shares on a yield basis amounting to barely 3¼ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 27th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1960 Highest	1960 Lowest
Electrical Shares—continued								
English Electric	£1	33/9	+6d	10	10	5 18 6	53/-	29/6
English Electic 3¾% Pref.	£1	11/-		3¾	3¾	6 16 6	13/-	11/-
Ericsson Tel.	5/-	25/6	+3d	13†	13†	4 3 0	28/6	20/6
Ever Ready	5/-	34/-	—9d	27½	20*	2 18 9	34/6	23/-
Falk Stadelmann	£1	24/9		10	7½	6 1 3	35/9	22/6
G.E.C.	£1	31/3	+3d	10	10	6 8 0	47/6	29/6
G.E.C. 6½% Pref.	£1	18/3		6½	6½	7 2 6	22/3	19/6
General Cables	5/-	4/3		15	Nil	—	10/-	4/9
Goblin (B.V.C.)	5/-	6/-		12½	10	8 6 9	13/9	6/-
Hackbridge Holdings	5/-	5/9		20	20	8 14 0*	8/9	5/9
Harland Engineering	5/-	18/6	+6d	14	16*	4 6 6	16/3	13/-
Head Wrightson	5/-	23/-	+6d	20	14*	3 0 9	31/6	20/6
Heatrae	2/-	13/9		20	22½	3 5 6	13/-	8/9
Holophane	5/-	18/9		26	30	8 0 0	20/6	16/-
Hoover	5/-	49/3	+2/-	90	45*	4 11 6	55/-	39/6
Hunt, A. H.	4/-	23/9	+1/9	15	20	3 7 3	24/6	16/9
Intl. Combustion	5/-	30/-	+2/6	30	30	5 0 0	46/9	23/3
Intl. Computers & T.	£1	77/6	+2/-	10	11½	2 18 0	78/6	58/9
Johnson & Phillips	£1	21/6	+1/6	5	Nil	—	24/-	16/9
Kenwood Mfg.	1/-	5/6		—	—	—	12/-	3/9
Laurence Scott	5/-	17/-		15	15*	4 8 3	25/3	15/9
Lister, R. A.	£1	54/-	+1/-	14	14	5 3 9	62/-	52/-
Lucas, J.	£1	65/6	+1/9	12½	13¾	4 4 0	74/6	58/9
Marryat & Scott	2/-	15/3		22½	27½	3 12 3	16/9	13/6
Mather & Platt	£1	49/3	—2/3	11	11	4 9 6	59/-	42/6
Metal Industries	£1	64/3	+1/-	14	15	4 13 6	76/3	52/6
Midland Elec. Mfg.	£1	58/9	—1/3	12	12	4 1 9*	61/-	53/6
Murex	£1	42/-	+6d	15	20	5 8 6*	45/-	35/6
Newman Ind.	2/-	5/6		12½	12½	4 11 0	5/3	4/-
Oldham & Son	1/-	3/-	+3d	17½	17½*‡	5 10 0	3/-	1/9
Parsons, C. A.	£1	50/6	+6d	8½	9¾	3 14 9	59/-	44/-
Philips' Lamps	Fl.10	230/-	+5/-	13·3	17	1 9 6	£12¾	137/-
Plessey	10/-	52/-		15¾‡	17‡	3 5 6	60/-	43/9
Pullin, R. B.	2/-	12/-		25	25	4 3 3	14/3	10/-
Pyrotenax	5/-	52/6	+6d	34	40	3 16 3	56/-	44/3
Radiation	£1	35/3		6	12	6 16 3	44/6	28/-
Reliance-Clifton	5/-	24/6		15	15	3 1 3	28/-	22/-
Reyrolle	£1	42/-		17½	17½	4 3 3*	52/3	33/9
Richardsons Westgarth	10/-	6/6		8½	8½	—	14/9	6/3
Sangamo Weston	10/-	27/6		12½	11*	4 0 0	27/-	19/3
Scott, James	5/-	25/9	—3d	24	25*	4 17 0	34/6	27/6
Simon Engineering	5/-	34/-	+1/3	—	26·6‡	3 18 0	33/-	28/-
Smith (England), S.	4/-	19/6	+9d	17½	20	4 2 0	20/-	15/6
Southern Areas	£1	17/-		Nil	5	5 17 9	16/-	13/-
Strand Elec.	5/-	14/9	+1/-	20	14·6*	4 18 6	14/-	10/6
Sturtevant	5/-	15/6		15†	15†	7 19 0	24/3	13/-
Sun Elec.	5/-	17/-		15	18½	5 8 9	17/6	15/-
T.C.C.	10/-	41/-		25	35	5 14 0*	48/3	37/3
Telephone Rentals	5/-	25/-		12½	15*	3 0 0	24/-	17/-
Thompson (John)	5/-	15/3		25	20	6 11 3	25/9	14/6
Thorn Elec.	5/-	53/-	+2/6	20	25	2 7 3	55/6	44/3
Thornycroft	£1	31/6		6	6	3 16 3	31/-	20/3
Tube Investments	£1	73/6	—1/-	—	14	3 16 0	95/6	65/3
Ultra Electric	5/-	18/-	+1/3	20	25	6 19 0	29/-	12/-
Walsall Conduits	4/-	12/3		22½	15*	4 18 0	16/-	10/9
Ward & Goldstone	5/-	29/3	+3d	30	35	3 0 0*	31/3	25/6
Watford	2/-	10/-	+6d	25	25	4 0 0*	14/-	7/6
Westinghouse	£1	40/6	+1/9	11	11	5 8 6	59/9	38/9
West, Allen	5/-	12/6		12½	12½*	5 0 0	17/-	11/-
Wilkins & Mitchell	5/-	13/3		17	21*	—	25/9	13/6
Wolf Electric	5/-	15/9		10	12½	3 19 3	14/9	10/9

M.E.M. Results

Earnings of Midland Electric Manufacturing in 1960 were nearly the same as for the previous twelve months and the dividend is to be repeated at the rate of 12 per cent to which it was raised a year ago. These results are very much in accordance with the chairman's statement on policy in the last annual report. The intention then was to reduce the selling prices of certain products, in the expectation that ultimately the level of trading profits would be maintained or improved through the enjoyment of an increasingly large share of the market. There is a yield of a fraction over 4 per cent on the £1 shares at 58s 9d.

Wireless Relay Issue

The British Relay Wireless and Television Company is raising some £1½ million fresh capital by a "rights" issue of new 5s shares, in which dealings began at a premium of about 6s on the offered price of 18s 6d. Certain large shareholders, said the company's statement, have agreed to subscribe for their full allotments. This is taken to refer mainly to British Electronic Industries (the Pye-E. K. Cole merger), Murphy Radio and Associated Television, all understood to have interests in B.R.W.'s progress, which has been both rapid and substantial over the past five years. It is the directors' intention to maintain the present dividend rate of 17 per cent, on which basis the new shares at an all-in price of 24s 6d (free of transfer stamp) yield 3½ per cent.

Engineering Reports

After being depressed to 27s 6d by the extent of the decline in profits shown in the preliminary statement on the annual results, International Combustion 5s shares recovered to 30s after the publication of the full report, in which the chairman describes prospects as brighter than they were a year ago and expects the improvement to be reflected in the group's earnings. This coincided with news of the company's participation in the orders for the projected West Burton power station. Mather & Platt's announcement of reduced profits in 1960 was unexpected; the price of the £1 shares came back at first from 51s 6d to 46s, but recovered later to 49s 3d. The dividend is repeated at a total of 11 per cent. Clarke Chapman are also making the same distribution as before from lower earnings; the shares were not much altered at 45s.

REPORTS and DIVIDENDS

International Combustion Prospects Brighter.—Future business prospects in the electricity supply industry are brighter than they were a year ago and in due course this improvement will be reflected in the company's earnings, states Mr. J. Reid Young, chairman of International Combustion (Holdings), Ltd., in his annual review.

Considerable fluctuations in the order book level from year to year must be expected, particularly now that the present policy of the Central Electricity Generating Board is to reduce the number of contractors participating in the construction of any one power station by the placing of much larger individual orders. This position is accepted by those engaged in the industry and the company has been able to withstand the changing conditions, although at the expense of reduced profits.

The value of orders received during the year ended 30th September, 1960, showed a reduction as compared with that of the previous year, but as stated the overall prospect has recently improved considerably. Group output for the year fell by about 13 per cent but the turnover achieved still remains high as compared with the capital employed in the business.

Sales of International Combustion (Export), Ltd., were considerably below those for the previous year, but even so work then in hand represented almost one third of the total order book of the group. There are substantial and potentially profitable projects under consideration in many parts of the world and it is to be hoped that the recent Government arrangement respecting the possible extension and liberalisation of credit facilities will assist materially in increasing the sale of capital goods overseas.

Clarke Chapman & Co., Ltd., are repeating a dividend of 13¾ per cent for 1960. The trading surplus is £951,041 (£1,038,042), including £200,000 (£300,000) estimated profits on long-term contracts in respect of prior years. The net profit after tax is £323,742 (£353,061).

Ether Langham Thompson, Ltd.—The directors recommend a final dividend of 12½ per cent for the year ended 30th September, 1960, making a total of 20 per cent. The net profit after tax is £152,877 (£50,502). The profit for the year consists of £125,356 in respect of J. Langham Thompson Group, Ltd., and its subsidiaries from the date of acquisition, 31st October, 1959, and £152,981 (£101,181) in respect of F. Ether Langham Thompson, Ltd., and the other subsidiaries, Electro Methods, Ltd., and Ether, Ltd.

A three-for-five scrip issue is proposed and permission is to be sought for increasing the share capital from £700,000 to £1,000,000.

Hall - Thermotank Outlook.—"Important and encouraging" indications of an improvement in future trading are outlined by Mr. J. F. E. d'A. Willis, chairman of Hall-Thermotank, Ltd. These, it is "confidently hoped," will prove more than sufficient to counteract the adverse factors, such as the dearth of new shipping construction, which in the immediate future are likely to act as a brake on progress. No slackening in demand for industrial refrigeration is apparent, and the group's share of available business is increasing. Very considerable progress is being made in the elevator and escalator field. In spite of a growing demand for air conditioning on land, it has been decided against participating in this highly competitive contracting field. Instead, the group will concentrate on the manufacture and sale of standardised equipment imported initially from the United States and, as and when economically possible, manufactured under licence. In this connection the group is now in the process of entering into an association with Westinghouse Electric of America.

Goblin (B.V.C.), Ltd.—A plea for continuity in Government financial policy to help industry in its planning was made by the chairman, Mr. O. D. Angell, at the annual general meeting last week. He recalled that a year ago the outlook held great promise for a new record year of trading. This promise was "rudely disturbed by the harsh and sudden resumption of controls." Experience in the export market had been encouraging but "only to the degree in which we have been able to keep our prices competitive." The chairman also referred to the efforts being made to render the fortunes of the company less vulnerable to extreme fluctuation by diversifying their activities. Developments to this end gave good grounds for encouragement.

Gas Purification & Chemical Co., Ltd., are not paying an interim dividend for the year to 30th June, 1961. Profit, before tax, for the six months to 31st December, 1960, was about £60,000 against £505,000 for the corresponding period o 1959, which is described as an exceptional period in trade generally. The main reasons for the decrease in profit were the difficult trading circumstances met by Grundig (Great Britain), Ltd., in its first four months and the effects of the recession in the radio and television industry on A.B. Metal Products, Ltd., and Wolsey Electronics, Ltd. Since a change in sales policy in November, it is stated, Grundig have been earning good profits, but some of these have been absorbed in rebates.

Midland Electric Manufacturing Co., Ltd.—The final dividend of 8 per cent makes 12 per cent for the year 1960 (the same). Group trading profit is £493,028 (£495,362) and the net profit after tax £266,299 (£264,645).

Electric & Musical Industries, Ltd., are paying an interim dividend of 5 per cent (the same).

Winding-up Petition

Reco Electronics, Ltd.—A petition for the winding up of the company has been presented by Associated Electrical Industries (Woolwich), Ltd., and is to be heard by the High Court, Strand, W.C.2, on 6th March.

Liquidations

Solihull Trading Co., Ltd., electrical wholesalers, 75, Duke Street, Birmingham, 4.—Winding up voluntarily. Liquidator, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3, appointed by creditors on 8th February. Particulars of claims to the liquidator by 29th April.

Maypole Electrical, Ltd., dealers in electrical goods, 45, North Street, Barking, Essex.—Meetings of creditors and contributories today (Friday) at Room 401, Inveresk House, 346, Strand, London, W.C.2.

A. Barlow & Co., Ltd., electrical contractors, 138, Church Hill, Loughton, Essex.—First and final dividend of 8¾d in the £ payable at 25, Bedford Row, London, W.C.1.

Veritys, Ltd. (creditors' voluntary winding up).—Meetings of members and creditors at the Chartered Auctioneers' and Estate Agents' Institute, Regent House, St. Philip's Place, Birmingham, 3, on 27th March, to receive an account of the winding-up by the liquidator, Mr. W. G. A. Russell.

Bankruptcies

L. A. L. Leech, lately carrying on business as T.L. Installation Co. (Norfolk & Suffolk) at 129a, Fore Street, Ipswich, contractor and electrical engineer.—Supplemental dividend of 1s 7d in the £ payable at 3-5, Northgate Street, Ipswich.

D. MacIntyre, Flat 1, Mayfield, Bray Road, Maidenhead, Berks., and lately residing at 196, Courthouse Road, Maidenhead, electrical engineer.—Order for discharge made 18th January, suspended for one month, subject to his consenting to judgment being entered against him for £400 and £1 10s costs, payable by monthly instalments.

J. C. A. Drew, formerly carrying on business in partnership with another as K. Roberts Electrical at 1-3, Oglander Road, London, S.E.15.—Order for discharge made 12th January, suspended for four months.

T. R. Thomas, electrical contractor, and **E. Jones,** television and radio engineer, carrying on business in co-partnership as T. R. Thomas & Co., at "Golden Key," Union Street, Dowlais, Glam., as electrical, television and radio engineers.—Last day for receiving proofs for dividend 7th March. Trustee, Mr. G. H. Down, 106, Walter Road, Swansea. Separate estate of E. Jones.—Last day for receiving proofs for dividend 7th March.

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 6th MARCH

Birmingham.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Centre. Discussion on "This house deplores the present rate of world expenditure on space research, while many problems of extreme poverty and sickness still exist on an international scale."

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "Plastics in the Electrical Industry," by A. J. Moulam.

Gloucester.—M.E.B. Sub-Area Offices, 6 p.m. I.E.E. Western Centre. "Short-Circuit Ratings for Mains Cables," by G. S. Buckingham, and "A Basis for Short-Circuit Ratings for Paper Insulated Cables up to 11 kV," by L. Gosland and R. G. Parr.

Ilford.—Angel Hotel, Broadway, 8.15 p.m. A.S.E.E. Essex Branch. "Suppression of Interference," by A. C. F. Leadbitter.

Kidsgrove.—English Electric Co., Ltd., 7 p.m. I.E.E. North Staffordshire Sub-Centre. "The Future of 'Electrics' and 'Electronics' in Aircraft and Guided Missiles," by Viscount Caldecote.

Leeds.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Electronics."

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "An Investigation of the Usefulness of Back-Scatter Sounding in the Operation of H.F. Broadcasting Services," by E. D. R. Shearman.

White Hall Hotel, Bloomsbury Square, W.C.1, 7.15 p.m. A.S.E.E. Central London Branch. "Contract Law and Agreements."

Maidstone.—Technical College, 7 p.m. I.E.E. Maidstone District Meeting. "Safety in the Utilisation of Electricity," by S. J. Emerson.

Manchester.—Engineers' Club, Albert Square, 7.30 p.m. Institute of Metal Finishing, North West Branch. "Chromate Treatment of Metals."

Newcastle-upon-Tyne. — County Hotel, Neville Street, 6.30 p.m. North East Electrical Club. "Infra-Red Gas Analysis," by A. E. Martin.

Rutherford College of Technology, Northumberland Road, 6.15 p.m. I.E.E. North Eastern Measurement and Electronics Group. "Applications of Microwaves," by A. L. Cullen.

TUESDAY, 7th MARCH

Birmingham.—James Watt Memorial Institute, Great Charles Street, 6.30 p.m. Institute of Metal Finishing, Midland Branch. "The Testing of Electrodeposits for Thickness and Corrosion Resistance," by J. Edwards.

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "An Oscillating Synchronous Linear Machine," by E. R. Laithwaite and R. S. Manak.

Farnborough.—Technical College, 6.30 p.m. I.E.E. Southern Graduate and Student Meeting. "D.C. Amplifiers," by H. Kemhadjian. (Preceded by a visit to Solartron, Ltd.)

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. "The Automatic Control of Machines for Assembling Mechanical Components," by A. V. Hemingway and R. L. Dressler.

White Hart, 49, King's Road, Chelsea, S.W.3, 7.45 p.m. A.S.E.E. West London Branch. "Power Factor Correction," by G. E. Bishop.

Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2, 6.30 p.m. Institution of Plant Engineers, London Branch. "Maintenance of Heat Exchangers," by H. B. Merriman.

Maidenhead.—College of Further Education, Bourne Road, 7.30 p.m. A.S.E.E. Reading and Districts Branch. "Panelec Floor-warming System," by D. W. Ackery.

Manchester.—Engineers' Club, 6.15 p.m. I.E.E. North Western Utilisation Group. "Electricity Generation and Transmission for a Group of Chemical Works," by F. H. Merrill assisted by J. F. Dowler.

Peterborough.—White Lion Hotel, Church Street, 7.30 p.m. Institution of Plant Engineers, Peterborough Branch. "Some Medium Sized Boilerhouses," by G. A. Rooley.

Workington.—College of Further Education, 7 p.m. I.E.E. North Eastern Centre. "Measured and Electrical Model Characteristics of Buildings Heated by Floor Thermal Storage," by E. D. Taylor, B. Berger and G. Blaylock.

TUESDAY, 7th MARCH to MONDAY, 3rd APRIL

London.—Olympia. Ideal Home Exhibition.

WEDNESDAY, 8th MARCH

Barnsley.—Town Hall, 7 p.m. I.E.E. North Midland Centre. Joint meeting with Sheffield Sub-Centre. "Radio Communication in the Power Industry," by E. H. Cox and R. E. Martin.

Birmingham.—Birmingham Exchange and Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Criminal Investigation," by Detective Inspector Ellis.

Bristol.—College of Technology, 7 p.m. I.E.E. Bristol Graduate and Student Section. Joint meeting with Institution of Mechanical Engineers. "Servomechanism Engineering," by E. B. Pearson.

Cardiff.—Welsh College of Advanced Technology, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. Discussion on "The Radio and Electronics Industry of South Wales," to be opened by N. Hughes, C. T. Lamping, D. R. Samuel and A. J. Shapland.

Edinburgh. — Department of Natural Philosophy, University, Drummond Street, 7 p.m. British Institution of Radio Engineers, Scottish Section. "High Speed Pulse Techniques," by E. Wolfendale.

Glasgow.—Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, C.2, 6 p.m. I.E.E. South West Scotland Sub-Centre. "New Ideas in Aircraft Electrical Systems," by M. Hancock.

London.—British Institute of Management, 80, Fetter Lane, E.C.4, 6.30 p.m. Institute of Metal Finishing, Organic Finishing Group. "Automatic Paint Finishing of Refrigerators," by B. Jeffery.

Luton.—College of Technology, Park Square, 8.15 p.m. A.S.E.E. Luton Branch. "Electronic Control of Machine Tools," by O. S. Puckle.

Maidstone.—Royal Star Hotel, 7.30 p.m. A.S.E.E. West Kent Branch. "Electricity and Road Transport," by C. T. Humpidge.

Manchester.—Midland Hotel, 6.45 for 7.15 p.m. I.E.E. North Western Centre. Annual dinner and reunion.

Newport (Mon.).—King's Head Hotel, 6.30 p.m. Newport and District Electric Club. "The Art of Public Speaking," by G. J. Rankin.

Northampton.—Room B16, College of Technology, 7.15 p.m. Northampton and District Electrical Association. "The History, Development and Manufacturing Techniques of the Avometer," by J. A. Thomas.

Nottingham.—Sherwood Room, County Hotel, Theatre Square, 7 p.m. Institution of Plant Engineers, East Midlands Branch. Annual meeting.

Oxford.—S.E.B. District Office, 37, George Street, 7 p.m. I.E.E. Oxford District. "Automatic Warehousing," by C. G. Bailey.

Rochester.—King's Head Hotel, High Street, 7 p.m. Institution of Plant Engineers, Kent Branch. Annual meeting.

Salisbury.—S.E.B. Showrooms, 17, New Canal, 6.30 p.m. I.E.E. Southern Centre. "A Survey of Street Lighting and its Future," by W. R. Stevens and H. M. Ferguson.

THURSDAY, 9th MARCH

Blackpool.—Illuminations and Electrical Services Department, Rigby Road, 2.30 p.m. I.E.S. Manchester Centre. "Blackpool Illuminations," by H. Carpenter.

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford and District Branch. "Trolley-bus Control," by D. Francis.

Dublin.—Physical Laboratory, Trinity College, 6 p.m. I.E.E. Irish Branch. "Design Manufacture and Service Performance of Rural Transformers in Ireland," by W. G. Scaife and M. P. Kealy.

Dundee.—Electrical Engineering Department, Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "Generator/Motor Problems in Pumped-Storage Installations," by J. H. Walker.

Glasgow.—Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. "High Speed Pulse Techniques," by E. Wolfendale.

London.—Connaught Rooms, W.C.2, 7 for 7.30 p.m. I.E.E. Supply Section. Dinner-dance.

Newcastle-upon-Tyne. — Old Assembly Rooms. Institution of Plant Engineers, North East Branch. Annual dinner and dance.

Southampton.—University, 7.30 p.m. Plastics Institute, Southern Section. "Control Instruments in the Plastics Industry," by J. A. Dugon.

Sunderland.—Technical College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. "Distribution Planning," by P. A. Balmbra.

Swansea.—Conference Room, South Wales Electricity Board, Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Some Considerations in the Application of Power Rectifiers and Convertors," by J. P. McBreen.

FRIDAY, 10th MARCH

Aberdeen.—Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Generator/Motor Problems in Pumped-Storage Installations," by J. H. Walker.

Blackburn.—White Bull Hotel. Institution of Plant Engineers, Blackburn Branch. Annual dinner.

Bristol.—Hawthorns Hotel. I.E.S. Bath and Bristol Centre. Dinner-dance.

Ipswich.—Electric House, 7.30 p.m. Institution of Production Engineers, Eastern Region. Ipswich and Colchester Branches. "The Status of the Production Engineer in any Sort of Economy," by H. Burke.

London.—Connaught Rooms, Great Queen Street, Kingsway, W.C.2. British Refrigeration Association. Luncheon.

Caxton Hall, Westminster, 6.30 p.m. Electrical Power Engineers' Association. Film "The Pioneers," A. E. Prophet.

Grosvenor House, Park Lane, W. Institute of Marine Engineers. Annual dinner.

Newcastle-on-Tyne. — Old Assembly Rooms, 7 p.m. I.E.E. North Eastern Centre. Annual dinner and dance.

SATURDAY, 11th to SUNDAY, 12th MARCH

Bridlington.—I.E.E. Sheffield Sub-Centre Graduate and Student Section. Week-end conference

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Argentina.—Transportes de Buenos Aires. 6th June. Electric railway coaches. (E.S.B. 32848/60.)*

Australia.—P.M.G.'s Department. 21st March. Switchboard parts and accessories. (E.S.B. 5576/61.)* 4th April. Lamps, lamp caps and jacks. (E.S.B. 5274/61.)*

Southern Electric Authority of Queensland. 19th April. Circuit-breakers and transformers. (E.S.B. 6425/61.)*

State Electricity Commission of Victoria. 12th April. 6·6/11 kV switchgear. (E.S.B. 6447/61.)*

Birmingham.—Corporation. 29th March. Street lighting equipment for the twelve months commencing 1st May. (See this issue.)

Brazil.—State Electric Energy Commission. 19th September. Rio Passo Fundo hydro-electric project. (E.S.B. 5537/61.)*

Burma.—Rangoon Electric Supply. 31st March. Electrical equipment. (E.S.B. 6433/61.)*

Canada.—Winnipeg Electric Co. 27th March. Electrical control equipment. (E.S.B. 5509/61.)*

Egypt.—Egyptian Territory Telecommunications Organisation. 1st May. Telecommunications equipment. (E.S.B. 5247/61.)*

Formosa.—Central Trust of China. 21st March. Twelve 150 kVA transformers. (E.S.B. 5267/61/I.C.A.)* 22nd March. One 100 h.p. motor. (E.S.B. 5270/61/I.C.A.)* Electric motor and starter, and storage batteries. (E.S.B. 5569/61/I.C.A.)* 23rd March. Generator and signalling equipment. (E.S.B. 5566/61/I.C.A.)*

Ghana.—Supply Commission. 12th April. P.v.c. insulated wire. (See this issue.)

Greece.—Hellenic State Railways. 21st March. Electric heating equipment and generators. (E.S.B. 4999/61.)*

India.—Madhya Pradesh Electricity Board. 14th April. 132, 33 and 11 kV transformers. (E.S.B. 6424/61.)*

Iraq.—Iraqi Ports Administration. 26th March. Distribution boards. (E.S.B. 6088/61.)* 16th April. Transformers. (E.S.B. 6419/61.)* Switchgear. (E.S.B. 6418/61.)*

Korea.—Korea Electric Power Co. 31st March. 30 MW generator. (E.S.B. 32453/60.)*

Magor and St. Mellons.—R.D.C. 17th March. Trunk road lighting. (See this issue.)

Manchester.—City Council. 21st March. Electrical installation in extensions to Didsbury Training College. City architect, P.O. Box 488, Town Hall.

New Zealand.—G.P.O., Wellington. 6th April. Capacitors. (E.S.B. 5257/61.)*

Wellington City Council. 21st March. Fuse and shackle insulators. (E.S.B. 5587/61.)* 22nd March. Cables. (E.S.B. 6039/61.)*

Northern Ireland.—21st March. Electrical installation in proposed extensions to Convent of the Sacred Heart Grammar School. McLean & Forte, architects, 37, Malone Road, Belfast.

Philippines.—National Power Corporation. 17th March. Transmission line hardware. (E.S.B. 6446/61.)*

Thailand.—Telephone Organisation. 21st March. Telephone cable. (E.S.B. 5298/61.)*

* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

ORDERS PLACED

Blackburn.—Corporation. Recommended. Electrical work in 66 dwellings at Burnley Road (£8,730).—North Western Electricity Board.

Lancashire.—Education Committee. Replacing lighting fittings and stage lighting installation at Thornton Cleveleys County Secondary School (£2,722).—L. Wetherley.

Newcastle-on-Tyne.—Regional Hospital Board. Electrical installation in a new department of physical medicine at Middlesbrough General Hospital (£4,462).—C. Horne & Co.

Sheffield.—Education Committee. Electrical installation work at Broomgrove and Woodville Hostels (£24,800).—T. W. Sampson & Co.

Regional Hospital Board. Recommended. Staff location system at Scartho Road Hospital, Grimsby (£1,126).—Multitone Electrics Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Barnsley.—Police headquarters (four-storey administration block, gymnasium, workshops, etc.), on site near Town Hall; Lanchester & Lodge, architects, 10, Woburn Square, London, W.C.1.

Barton-on-Humber (Lincs.).—Single-bedroom flats, Finkle Lane, Sowtergate and Hungate; U.D.C. surveyor.

Bath.—Central police station, Manvers Street, and five blocks of maisonnettes and flats, Twerton/Whiteway estate; planning officer, 7, North Parade Buildings.

Bedfordshire.—Family group homes at Dunstable and Leagrave, and county primary schools at Shillington and Wootton; county architect, Shire Hall, Bedford.

Birchington.—Flats (70), near Beresford Hotel; Dolphin Development Co., Ltd., Duncan House, Dolphin Square, London, S.W.1.

Cardiff.—Extensions to Glyn Derw County Secondary School (two-storey and single-storey blocks); city architect, Municipal Offices, Greyfriars Road.

Castle Donington.—Houses (68), Windmill Fields estate; McCarthy Collings & Co., architects, 187, Forest Road, Coalville.

Chesterfield.—Bus depot (£693,000); borough surveyor.

Crosby.—Crematorium; T. W. Crookdake, architect, Waterloo Offices, Liverpool, 22.

Dagenham.—Factory and offices, Fowler Road, Hainault; Glendale Cabinet Co., Ltd., Commercial Road, London, E.1.

Doncaster.—Extensions to Technical High School for Boys; borough architect.

Edgware.—Flats (44), Purcells Avenue; Sterling Homes, Ltd., 26, Manchester Square, London, W.1.

Glasgow.—Shops as part of development of Castlemilk site; L. H. Fewster & Partners, architects, 22, Conduit Street, London, W.1.

Ilford.—Departmental store extensions; Moultons, Ltd., High Road.

Ipswich.—Secondary modern school, Chantry estate; Johns, Slater & Haward, architects, 32, Foundation Street.

Kendal.—Reconstruction of Highgate Hospital; J. L. Le Fevre, architect, Lowther Street.

Kettering.—Hospital scheme including X-ray and operating blocks, nurses' training school, casualty, dining, out-patients' and gymnasium blocks (£634,000); Mitchell Construction Co., Ltd., Peterborough.

Lincoln.—Library and clinic, Ermine estate; R. R. Alexander, city architect, Stamp End.

London.—Laboratories; Aircraft Steel Structures, Ltd., Western Avenue, W.3.

Factory, Radstock Street, Battersea; John Roberts, Ltd., 29, Battersea Bridge Road, S.W.11.

Rebuilding Colfe's Grammar School, Horn Park Lane, Lewisham; Louis de Soissons, architect, 3, Park Square Mews, N.W.1.

Church, Stirling Road, Wood Green; J. Barrington-Baker, architect, 32, Queen Anne Street, W.1.

Maidenhead.—Houses (354), Woodley; Bestwick & Taylor, Ltd., Raymill Road.

Manchester.—Aged persons' homes at Wythenshawe and Harpurhey; city architect, P.O. Box 488, Town Hall.

Newbury.—Houses (106), Turnpike Road estate; H. Ridge & Partners, quantity surveyors, 79, Petty France, London, S.W.1.

Newcastle-on-Tyne.—Welfare centre at Fawdon; Ryder & Yates, architects, 87, Jesmond Road.

North Riding.—Fire and ambulance station at Redcar, old people's home at Eston, and infants' school at Thornaby; county architect, County Hall, Northallerton.

Northampton.—Radiotherapy department, General Hospital; Simcock & Usher, Ltd., St. Leonards Road.

Northants.—Extensions to Raunds Secondary Modern School (£85,300), and Wellingborough Day Special School and Hostel (£72,515); county architect, Northampton.

Orpington.—Civic hall extensions; Seely & Paget, architects, 41, Cloth Fair, London, E.C.1.

Portsmouth.—Factory, Eastern Road, Farlington; Lamson Paragon, Ltd., Paragon Works, Canning Town, E.16.

Rowley Regis.—Three-storey flats (88), Bury Hill; borough engineer, Municipal Buildings, Old Hill, Cradley Heath, Staffs.

Rugby.—Works, Leicester Road; Combined Constructions, Ltd., 1a, Manor Road.

Salford.—Works and offices; Barlow & Cidlaw, Ltd., Pendleton Gear Works, Grafton Street.

Scunthorpe.—Crematorium, Brumby Wood Lane; borough surveyor.

Stirling.—Houses (31), Academy Road/St. John Street area; burgh architect, Old Burgh Buildings, King Street.

Stoneleigh.—R.C. church; Justin H. Alleyn, architect, 1, Berners Street, London, W.1.

Stourbridge.—Block of shops and dwellings, Lye Cross; H. Morris, borough engineer, Council House.

Stretford.—Flats and aged persons' dwellings (54), Barton Road sites; A. H. Perry, borough engineer, Town Hall.

Thetford.—Houses (120), London Road; W. F. Pointer & Sons, Ltd., Hotblack Road, Norwich.

Wanstead.—Flats (20), with underground car park, High Street; Tooley & Foster, architects, Midland Bank Chambers, Buckhurst Hill.

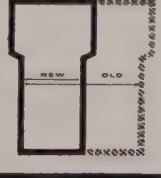
Wigston (Leics.). — Proposed swimming baths (£20,000); U.D.C. surveyor.

THE NEW TUDOR 'SAFETYLYTE' EMERGENCY LIGHTING EQUIPMENT

There is now an advanced version of the well-established Tudor 'Safetylyte' Emergency Lighting Equipment—the equipment that springs automatically into action the moment any interruption occurs in the normal mains supply, and provides emergency lighting protection in any type of public building.

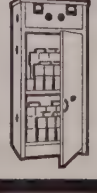
This advanced equipment makes full use of the new Tudor High Performance Cell*, and is housed in a cubicle of improved design. The larger cubicles are now constructed of folded sheet steel with the instrument panel recessed and the front door hinged to give ready access to internal components. The equipment is available in both maintained and non-maintained types. For small lighting loads, wall-mounted cubicles (employing automatic mercury relay in place of a contactor) can be supplied. Self-contained trickle charge/floating battery equipment has also been designed for small buildings.

*The new Tudor High Performance Cell



Provides a saving in space of up to 50% when compared with BS sealed cells, while retaining the advantages of long life, reliability and negligible maintenance.

Improved Switch Tripping Equipment

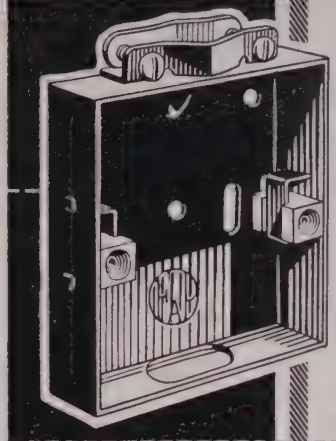


Tudor Switch-tripping units are now being fitted with the new High Performance Cell. The cubicles have also been redesigned and are available in folded sheet steel or wooden cabinet construction. The charger can now be used for both trickle and quick charging.

T174

Tudor SAFETYLYTE EMERGENCY LIGHTING EQUIPMENT

THE D.P. BATTERY CO. LTD, MANUFACTURERS OF KATHANODE AND TUDOR BATTERIES, BAKEWELL, DERBYSHIRE · TELEPHONE: BAKEWELL 581-5



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PLASTER DEPTH SWITCH BOX

- 2¾" fixing centres with sliding insulated lugs
- Lugs made from nylon threads will not strip
- Available in 1 & 2 gang with grommet or clip grip entry

Another recent addition to our already comprehensive range of malleable and pressed steel fittings

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WEATHERPROOF METAL-CLAD SOCKETS, PLUGS, SWITCH SOCKETS etc.

for all electrical purposes

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SIMMONDS & STOKES (NIPHAN) LTD

MANUFACTURING ELECTRICAL ENGINEERS

Victoria House, Southampton Row, London, W.C.1. HOLborn 2163, 8637

Hendrey Spark Recorder Type 1487A

For full details and specification ask for Catalogue Sheet

A4

Compact and weatherproof, this single channel recorder is light in weight and easily portable. The perspex window gives a clear view of the heat sensitive chart for approximately 6" of its length.

The instrument can also be used mounted on bench, wall or panel and is supplied with mounting plate incorporating three anti-vibration mountings which render the instrument shock-proof and vibration-proof to service standards.

An electro-magnetically operated stylus, operated by a separate switch not supplied with the recorder, provides transverse markings near the edge of the chart. Provision is made for an external alarm circuit which can be pre-set to operate at any deflection from zero to full scale by means of a control on the case.

Sensitivity—50 micro-amps. Full scale.

Supply—12 Volt, D.C.

Hendrey Relays

HENDREY RELAYS LIMITED

392 BATH ROAD, SLOUGH, BUCKS. *Burnham 609/61*

MANUFACTURING ELECTRICAL ENGINEERS CONTROL AND LABORATORY APPARATUS A.I.D. AND A.R.B. APPROVED

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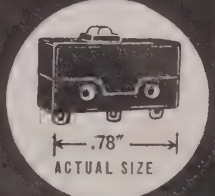


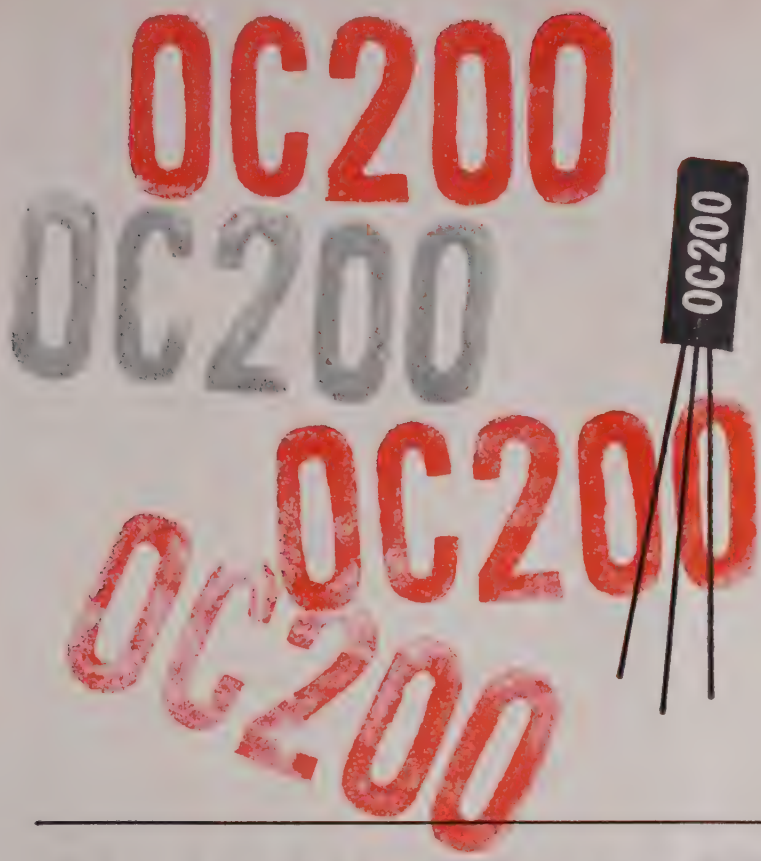
The New BURGESS V-4

- No larger than the average cuff-link
- New mechanism has mechanical life of at least 10 million operations
- Three types of solder terminals available
- Comprehensive range of auxiliary actuators

BURGESS MICRO SWITCHES

ELECTRICAL ENGINEERS EXHIBITION STAND D11

BURGESS PRODUCTS COMPANY LTD, MICRO SWITCH DIVISION, DUKES WAY, TEAM VALLEY, GATESHEAD 11
Telephone: Low Fell 75322. Telex: 53-229 London Office: 127 Victoria Street, SW1. Telephone: TATe Gallery 0251 Telex: 25601



SILICON CHARACTERISTICS AT GERMANIUM PRICE

* now costs less than any other silicon alloy transistor
* now even cheaper than many germanium types

SO NOW you can specify a quality silicon alloy transistor — in most of those instances where previously silicon semiconductors were considered too costly. What's more, there are no delivery problems. Thanks to Mullard large scale production, the OC200 is available for immediate delivery in quantity.

Already, of course, the OC200 has proved its worth in practical applications. Low bottoming voltage . . . low noise figure . . . unusually wide temperature range. The OC200 has all the attributes you could wish for in a general purpose transistor. It is suitable for use at low and high temperatures in switchgear and a wide variety of industrial equipment. And now that price is no problem — the scope of the OC200 grows wider still. If you would like further details simply write to the address below.

Minimum operating ambient temperature	(°C)	− 50
Maximum junction temperature	(°C)	+ 150
Abridged data (at Tamblent 25°C)		
V_{cb} max.	(V)	− 25
V_{ce} (cut-off) max.	(V)	− 25
V_{ce} (I_c=50mA) max.	(V)	− 20
I_c (pk) max.	(mA)	50
I_c max.	(mA)	50
α' (f=1kc/s) spread		15 to 60
V_{ce} (I_c=7mA, I_b=1mA)	(mV)	− 130
r_{bb}' (V_{ce}= −6V, I_c=1mA)	(Ω)	125

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EXHIBITION
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Old J.B.'s sitting on top of the world
Well, not exactly. Looks happy
though. I wonder? Let's see
Power Centre man called on Monday,
P.C. discussion on Wednesday,
out to lunch with P.C. man on
Friday. Power Centre? Got it!
J B.'s installing Power Centre
Trunking. No wonder he looks
happy. Just think, P.C. trunking
throughout. All the top people
use it. It's zinc coated for exceptional
durability and cuts installation costs
by as much as 33⅓% What an
investment. Wise man J.B.
Always goes the right way about
tackling a job.

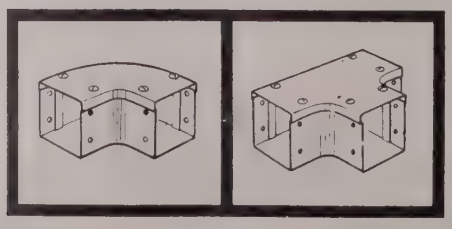
If you've got a trunking job in mind, take the first step in the right direction by contacting Power Centre, or, send for their fully descriptive literature.

Address to
THE POWER CENTRE CO., LTD.
P.O. BOX 18, LLOYD STREET,
WEDNESBURY, STAFFS.
Telephone: Wednesbury 1311.

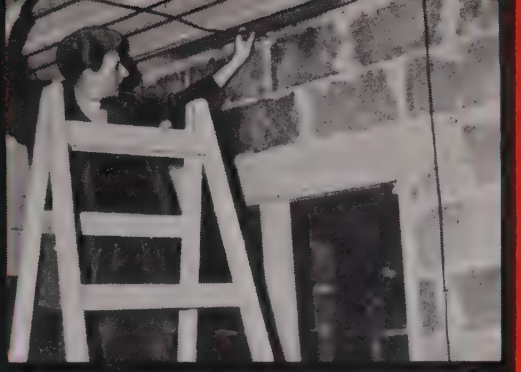
Stocks in all Simplex Branches throughout the country.

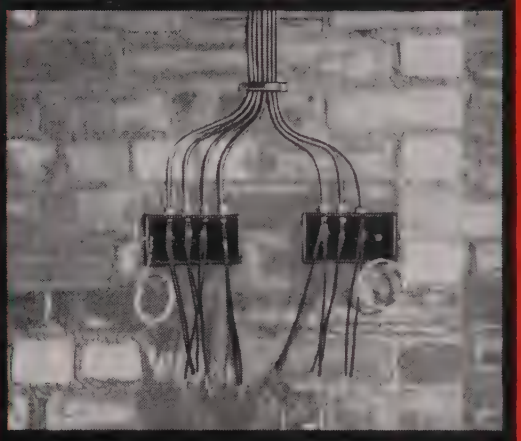
ELECTRICAL DIVISION

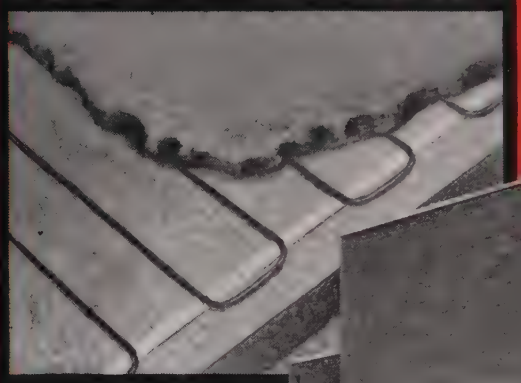
POWER CENTRE



Power Centre trunking fittings. Precision made. Speeds the job of installation. Layout extension or alteration made easy. Shown left, Elbow Assembly and Tee Assembly.







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the supreme wiring system for lighting, power and heating

"Pyrotenax throughout". What could be more logical? With seamless copper sheath, and high conductivity copper conductors embedded in pure mineral insulant, Pyrotenax cable is second-to-none for reliability, permanence and safety.

Other advantages are—cable and conduit combined – non-ageing – unobtrusive—pliable – fireproof and non-fire causing – resistance to damage. Among these economy is not the least, thanks to the speed and neatness of installation.

These are characteristics it is good to have throughout the entire wiring system—rising mains, lateral wiring, power outlets, fire alarm circuits or warming cables.

No wonder more and more people are specifying Pyrotenax—by name—throughout.

A ELECTRICAL ENGINEERS EXHIBITION

STAND G9

"Pyrotenax throughout"—for 243 new flats at South Shields, for South Shields Corporation.

243 dwellings, are provided in this progressive housing enterprise. PVC-sheathed Pyrotenax floor warming cable is installed in each hall and living room, and Pyrotenax in the form of pre-assembled cable units is used for the general electrical installation throughout.
Electrical Contractors: A. Robertson Ltd. South Shields.

PERFECTED BY EXPERIENCE

Pyrotenax

m.i. COPPER COVERED CABLE

The use of the trade name 'Pyrotenax' is exclusive to the products of this Company and its associates.

GD 582

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for London's tallest building—34 storeys high

AEI CABLES specified

The Millbank Development Scheme

now being erected on the North Bank of the Thames at Millbank, London SW1.

Architects:
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29 Chesham Place,
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Electrical Contractors:
Troughton & Young Ltd.
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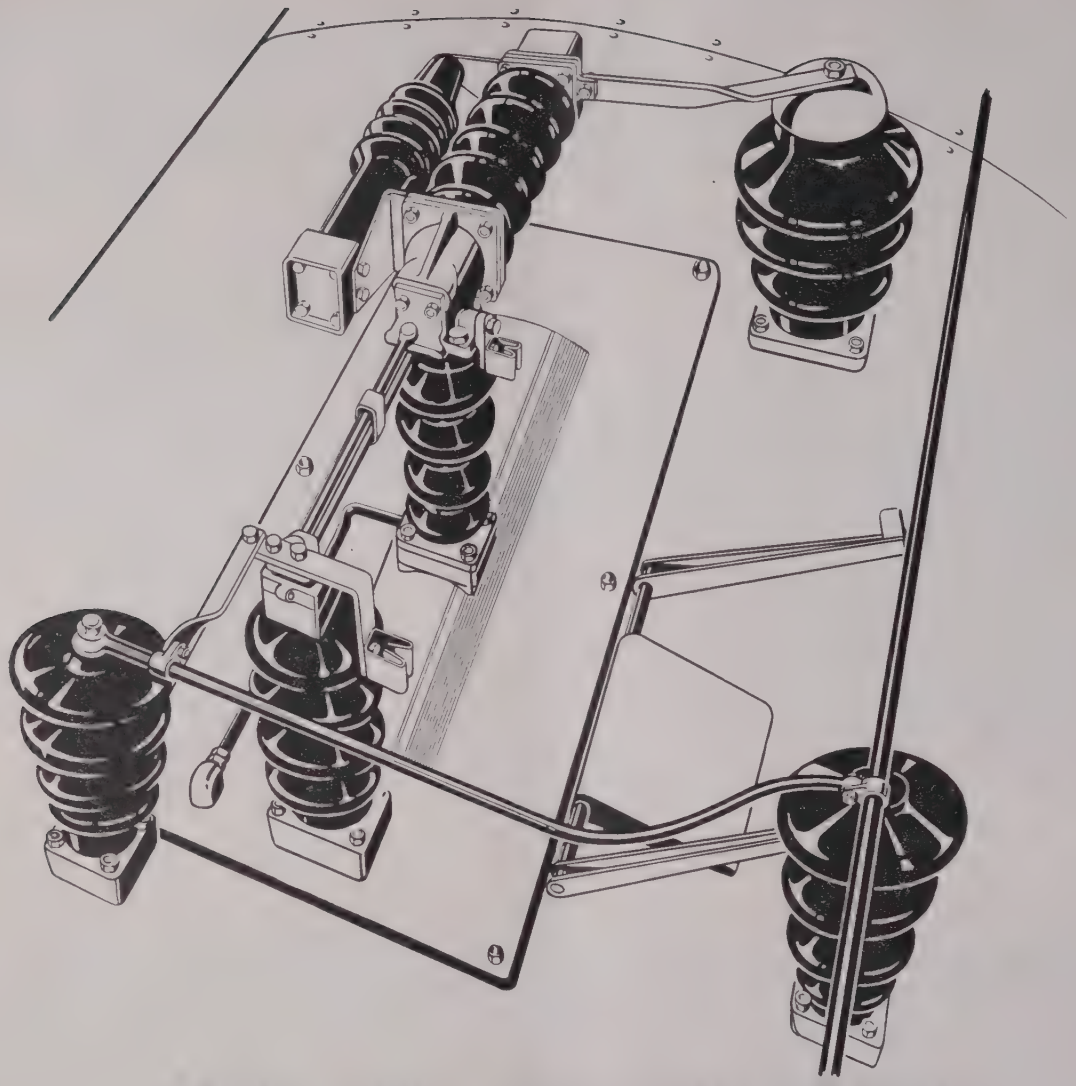

MAIN-LINE ELECTRIFICATION

This Reyrolle 25-kV single-phase air-blast circuit-breaker has been designed specifically to control the incoming supply to electric locomotives

400 amperes current rating.
250-MVA breaking capacity at 25 kV.
Compact and robust construction.
Simple six-bolt fixing to roof of cab.
Immediate access to all major working-parts to facilitate maintenance.
Operation from locomotive's compressed-air system.

Reyrolle

Hebburn - County Durham - England

tubular SHEATHED ELEMENTS

made to individual
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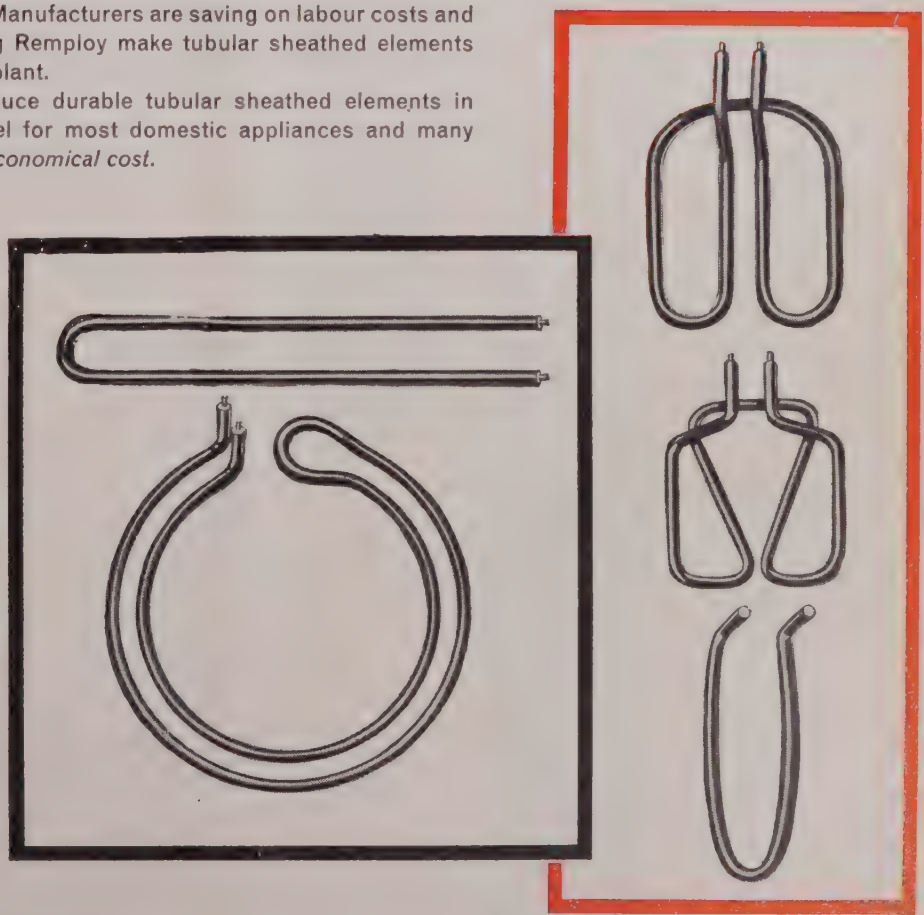
by *Remploy*

More and more British Manufacturers are saving on labour costs and factory space by letting Remploy make tubular sheathed elements for their products and plant.
For Remploy can produce durable tubular sheathed elements in copper, steel or inconel for most domestic appliances and many industrial uses—*at an economical cost.*



Why not send in your particular specifications *now?* Include as much detail as possible regarding:-

* Application (whether the element is to heat water, metals, oil, chemical solutions, etc.).
* Sheath material required.
* Working voltage.
* Quantity required and any other information you think would help us prepare your quotation. Blue prints and the prototype of your appliance would be particularly useful if available.

And remember, Remploy Technical Representatives are always at your service without obligation. This can be of great assistance when developing a new product.

For highly efficient, tubular sheathed elements in voltages from 110 to 280 volts: write to:

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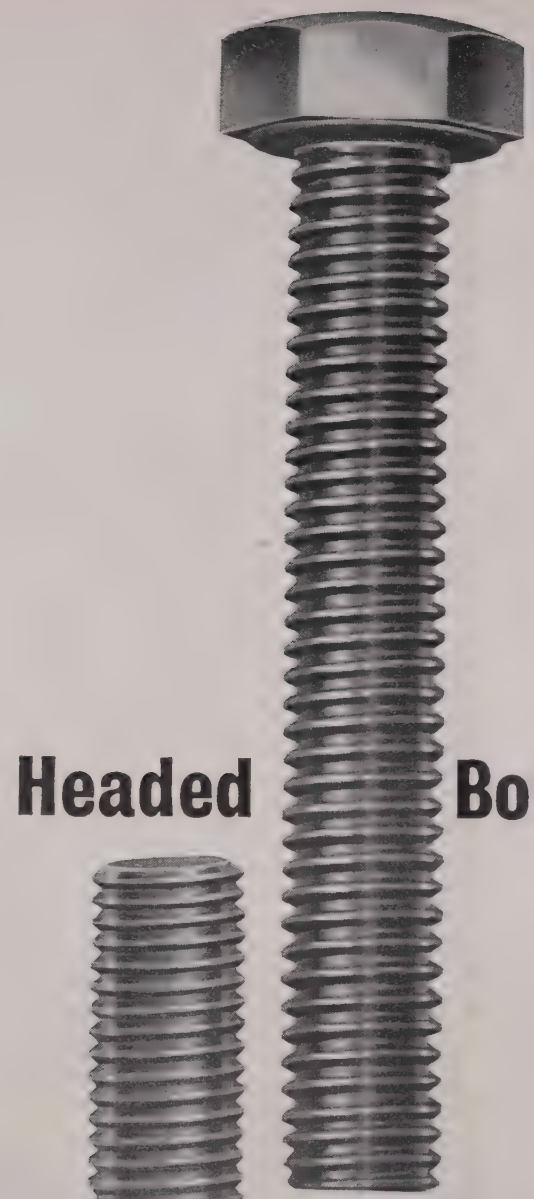
Phone: HOP 2206



Cold Headed Bolts and Set Screws

Why look elsewhere, when all the benefits of long specialization plus the closest adherence to exacting quality standards are so conveniently available. Let ORMOND quote for all Repetition Parts—for single and multi spindle automatics up to $1\frac{1}{4}''$ diameter; Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grub screws, Nuts, Allthreads, Hexagon Bolts and Set screws turned from bar and Cold Headed Grades "A", "B" and High Tensile.

THE ORMOND ENGINEERING CO. LTD.
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Dorset House, Stamford Street
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Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

MAGOR AND ST. MELLONS RURAL DISTRICT COUNCIL

Street Lighting Scheme: A.48 Trunk Road

THE Council invite tenders for the above scheme, comprising :—

CONTRACT No. 1—Supply and erection of 179 columns, lanterns, with ancillary works.
CONTRACT No. 2—Supply and laying of cable (approximately 10,000 yards).

The proposed works are on the main Newport to Cardiff road and extend from the boundary of the County Borough of Newport at Ebbw Bridge to the boundary of the City of Cardiff at St. Mellons.

Specifications, bills of quantities, conditions of contract and forms of tender for each contract may be obtained, and plans inspected, upon application to the Council's Engineer, at the undermentioned address, on payment of a deposit of £3 3s., returnable upon receipt of a bona fide tender not subsequently withdrawn.

Tenders on the prescribed form, together with priced bill of quantities, in a plain envelope endorsed "Street Lighting, Contract No. 1" and/or "Street Lighting, Contract No. 2," must be addressed so as to reach the undersigned not later than 10 a.m. on Friday, 17th March, 1961.

The Council does not undertake to accept the lowest or any tender, and any acceptance shall be subject to the approval of the Minister of Transport.

H. E. M. KEENE,
Clerk of the Council.

Council Offices,
Baneswell,
Newport, Mon.
24th February, 1961. 7929

LLANELLY RURAL DISTRICT COUNCIL

Sodium Lighting on Trunk Road A.48 (Crosshands)

TENDERS are invited by the above Local Authority for the following on a Fixed Price Basis on Trunk Road A.48, within the Rural District of Llanelly :—

(a) Supply and erection of 12 Steel Columns with 140-watt Sodium Discharge Lamps.
(b) Supply and erection of 2 Steel Columns with 85-watt Sodium Discharge Lamps.
(c) Supply and delivery only of 21 140-watt Sodium Discharge Lamps complete.

Copies of specification, bill of quantities and plans may be obtained by post from the Architect and Surveyor to the Council, 2, Queen Victoria Road, Llanelly, on payment of a deposit of £2 2s., made payable to the Llanelly Rural District Council, which will be returned on receipt of a bona fide tender and return of documents loaned.

Tenders marked "Street Lighting A.48," in plain sealed envelopes, should be lodged with the undersigned not later than 12 o'clock noon on Tuesday, 14th March, 1961. The lowest or any tender will not necessarily be accepted.

C. B. HUGHES,
Clerk to the Council.

Castle Buildings,
Llanelly, Carms.
14th February, 1961. 7795

CLASSIFIED ADVERTISEMENTS ARE PREPAID

CITY OF BIRMINGHAM

THE PUBLIC WORKS COMMITTEE invite tenders for the supply and delivery of ELECTRIC STREET LIGHTING EQUIPMENT for the 12 months' period commencing 1st May, 1961, as follows :—

2,500 Cast Iron Columns (Class "B").
2,500 Combined Lanterns and Brackets (Class "B").
4,000 Synchronous Time Switches.
500 Keep Left Bollards.

Forms of tender, specifications and drawings, together with conditions of contract, may be obtained from the office of the City Engineer and Surveyor, Civic Centre, Birmingham, 1.

Tenders, enclosed in the envelope provided for the purpose, must be sealed and delivered to the Town Clerk's Office (Room No. B.21), Council House, Birmingham, 1, not later than 12 noon on Wednesday, 29th March, 1961, when they will be opened. Tenders received after that time will be rejected.

The Committee do not bind themselves to accept the lowest or any tender.

T. H. PARKINSON,
Town Clerk.

Council House,
Birmingham, 1. 7892

GHANA SUPPLY COMMISSION TENDER FOR SUPPLY OF PVC INSULATED CADMIUM COPPER WIRE AND HARD DRAWN COPPER WIRE

THE GHANA SUPPLY COMMISSION invite manufacturers to apply for tender for the supply of the following :—

Ref. PAT 4082/1 Description:
(a) 66,000 yards of PVC Insulated Cadmium Copper Wire.
(b) 34½ tons Bare Hard Drawn Copper Wire.

Forms of tender and conditions of contract will be obtainable from the 15th March, 1961, on payment of a fee of £1 from the Secretary, Ghana Supply Commission, P.O. Box M.35, Accra, Ghana.

Forms of tender will not be issued after the 5th April, 1961. The closing date for receipt of tenders will be 12th April, 1961. 7910

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

LONDON ELECTRICITY BOARD

Engineering Draughtsman

APPLICATIONS are invited for the above position in the Board's North Western District at Lithos Road, Hampstead, London, N.W.3.

Candidates should have a good general and technical education and be in possession of the Ordinary National Certificate, be neat and capable draughtsmen, and be experienced in one or more of the following subjects: drawing office routine, electrical diagrams, layout of plant in transformer chambers, mains survey and recording of mains work. A knowledge of building construction would be an advantage.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 13, £815 to £920 per annum, inclusive of London allowance.

Applications stating age, qualifications and experience should be sent direct to the Manager, North Western District, Lithos Road, Hampstead, London, N.W.3, within 10 days of the publication date of this notice. Please quote ref. PER/V/3221/R. 7900

ELECTRICAL SHIFT CONTROL ENGINEER

UNITED KINGDOM ATOMIC ENERGY AUTHORITY PRODUCTION GROUP

requires an Electrical Shift Control Engineer at

CAPENHURST WORKS CAPENHURST, CHESTER

to be responsible to the Electrical Operation Control Engineer for:

(a) Operation of 132-kV switchgear, supervisory control of a number of large sub-stations in accordance with instructions issued by the C.E.G.B. Grid Control Centre, and for the operation and control of E.H.V., H.V. and M.V. switchgear and ancillary equipment on the extensive power networks associated with this large and continuously operating chemical engineering works.

(b) Supervision of Shift Control and Sub-station staffs, issue of operational instructions and permits and preparation of statistics and electrical information.

A recognised electrical engineering apprenticeship, some years' experience in the control of large power networks with either a public electricity supply authority or a large industrial undertaking, and experience in the control of staff and industrial employees, are required. A good working knowledge of the various designs of switchgear, E.H.V., H.V. and M.V. and of all ancillary equipment including protective systems, experience in the operation of a Permit-to-Work certificate system and sound knowledge of the Electricity Regulations, are also essential. Possession of a Higher National Certificate in Electrical Engineering with exemptions leading to GRAD. I.E.E. is essential and a C.E.G.B. Authorisation, or its equivalent, will be an advantage.

Salary will be assessed within the scale £1,490-£1,715, according to qualifications and experience.

Contributory Pension Scheme.

Housing or assistance towards legal expenses on house purchase may be available.

Send postcard for application form, quoting reference CAP.272/J7, to Personnel Manager, at the above address.

Closing Date: 20th March, 1961

7890

SALES ENGINEER

is required by large Danish Company, already established in this country, to promote sales throughout the United Kingdom of contactor starter gear. Experience of selling in this market, energy and initiative are required for this position in a rapidly expanding organisation.

Details of experience, age and salary should be sent in confidence to—Box 7913.

***Situations Vacant** (continued)*

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT ENGINEER (Operation and Maintenance), Croydon and West Kent Area Headquarters.

Salary N.J.B. Class K, Grade 10, £1,165-£1,295 per annum, including London allowance. Superannuable.

Candidates should be either Corporate or Graduate Members of the Institution of Electrical Engineers and have had experience in the operation and maintenance of distribution systems up to and including 33 kV.

Applications, quoting ER, and naming two referees, on forms from the Croydon and West Kent Area Manager, Electric House, Wellesley Road, Croydon, by 15th March, 1961.

ASSISTANT DISTRICT ENGINEER, Croydon and Purley District.

Salary £1,165-£1,295 per annum, including London allowance under N.J.B. Agreement, Class J, Grade 9. Superannuable.

Applicants should be suitably qualified and have operational experience of maintenance and construction on distribution system up to 11 kV. Candidates should also have experience of planning work.

Applications, quoting ER, and naming two referees, on forms obtainable from District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 15th March, 1961.

ASSISTANT DISTRICT ENGINEER, Guildford District.

Salary £1,040-£1,165 under N.J.B. Class F, Grade 7. Superannuable.

Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of MV and 11-kV underground and overhead systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The successful applicant will be required to undertake standby duties.

Applications, quoting ER, and naming two referees, on forms from District Manager, SEEBOARD, Woodbridge Road, Guildford, Surrey, by 15th March, 1961.

ASSISTANT DISTRICT ENGINEER, Woking District.

Salary £765-£870 p.a. under N.J.B. Agreement, Class F, Grade 11. Superannuable.

This appointment occurs in a rapidly expanding urban and rural district. Applicants should have minimum qualification of the O.N.C. in Electrical Engineering and should possess general engineering experience, preferably in the electricity supply industry.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 4, Chobham Road, Woking, Surrey, by 15th March, 1961.

ASSISTANT DISTRICT ENGINEER, Twickenham and Richmond District.

Salary £1,040 - £1,165 p.a. plus London allowance under N.J.B. Class F, Grade 7 (re-classification to Class G in April, 1961). Superannuable.

Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of MV and 11-kV underground systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The successful applicant will be required to undertake standby duties.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 42, York Street, Twickenham, Middlesex, by 15th March, 1961.

GEORGE WRAY,
Secretary. 7919

TEST ASSISTANT

for large Transformer Test Department.

Staff position. Young man 23-30 with suitable background and experience as an electrician will be considered for training.

Minimum commencing salary £13 per week.

Apply:—

FULLER ELECTRIC LTD.
Fulbourne Road, London, E.17

7917

THE HEAD WRIGHTSON MACHINE COMPANY LTD.

have vacancies at their Middlesbrough Office for

1. ELECTRICAL ENGINEERING ASSISTANT

Applicants should have general knowledge of motor and control gear applications and be able to prepare schematic diagrams for preliminary schemes.

Higher National Certificate in electrical engineering or equivalent preferred.

2. ELECTRICAL ENGINEERING DRAUGHTSMEN

Applicants should have general knowledge of motor and control gear applications and be able to assist in the layout of schematic and wiring diagrams.

Qualifications to Ordinary National Certificate in electrical engineering required.

Staff Pension and Life Assurance Scheme, assistance with house purchase. Write stating age, experience, technical qualifications and salary range to:—The Personnel Manager, Ref.M/12, Teesdale Iron Works, Thornaby-on-Tees.

7894

ELECTRICAL ENGINEERING

in the

FOOD INDUSTRY

A vacancy has arisen at our Head Office in North-West London for an ASSISTANT ELECTRICAL ENGINEER whose duties will embrace the preparation of specifications for electrical installations in factories, negotiation of contracts, design of control schemes and the laying down of standards for electrical equipment.

Candidates should have minimum qualifications of H.N.C., a recognised apprenticeship and about three years' experience in similar work.

This opportunity arises out of further development in the Engineering and Construction Division and offers a good, progressive salary with excellent employment conditions which include a non-contributory pension and free life assurance.

Applications with a brief outline of personal history should be addressed:

The Personnel Officer
H. J. HEINZ COMPANY LIMITED
Waxlow Road, Harlesden, London, N.W.10

7855

THERMODARE (GREAT BRITAIN)

REQUIRE the following Staff to meet vacancies created by planned expansion—

1. TECHNICAL REPRESENTATIVES—Floor-Warming Division.
2. TECHNICAL REPRESENTATIVES—Thermal-Storage Division.
3. SALES REPRESENTATIVES—Infra-Red Division.

Applicants should be between 25–35 years of age, with previous experience in Electrical or Heating Trades. Good salary, commission, expenses and car allowance.

4. TECHNICAL ASSISTANT required for computation of Industrial/Commercial Infra-Red Heating Schemes.

An excellent opportunity for keen and conscientious men to join a vigorous and progressive young Company, who are pioneers in the techniques of these advanced forms of electric heating. Pension and good prospects of promotion.—Write full details in confidence to—E. C. Green, 94/98, Petty France, London, S.W.1.

7866

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

STATION SHIFT CONTROL ENGINEER, DRAKELOW "A" POWER STATION (Vacancy No. 27/61).

Applications are invited for the position of STATION SHIFT CONTROL ENGINEER at Drakelow "A" Power Station, near Burton-on-Trent, Staffs.

Applicants should have had a good general education and technical training with practical experience in the control and operation of large modern switchgear. Preference will be given to candidates who possess technical qualifications to Higher National standard.

Salary will be in accordance with Class J, Grade 10 (£1,040-£1,165 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th March, 1961.

ASSISTANT ENGINEERS (OPERATION), HIGH MARNHAM POWER STATION (Vacancy No. 28/61).

Applications are invited for the positions of ASSISTANT ENGINEERS (Operation) at High Marnham Power Station, near Newark, Notts.

Applicants should have experience of the operation and control of modern high-pressure boiler and turbine plant, and should possess a H.N.C. in Mechanical or Electrical Engineering, but consideration will be given to those holders of a lower technical qualification who have sound operating experience.

Salary will be in accordance with Class N, Grade 10 (£1,350-£1,500 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th March, 1961.

ASSISTANT COAL AND ASH HANDLING ENGINEER, DRAKELOW "A" AND "B" POWER STATIONS (Vacancy No. 29/61).

Applications are invited for the position of ASSISTANT COAL AND ASH HANDLING ENGINEER at Drakelow "A" and "B" Power Stations, near Burton-on-Trent, Staffs.

Candidates should have knowledge of the operation of coal, ash and dust handling plant at a large modern power station, and of the organisation and planning of coal supplies by road and rail.

The duties of the successful applicant will include the organisation of ash disposal by lorry transport.

Salary will be in accordance with Class M, Grade 10 (£1,275-£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th March, 1961.

SHIFT CHARGE ENGINEER, LEICESTER POWER STATION (Vacancy No. 34/61).

Applications are invited for the position of SHIFT CHARGE ENGINEER at Leicester Power Station, Rawdykes Road, Leicester.

Applicants should preferably hold a Higher National Certificate and have had experience in a modern P.F. fired station.

Salary will be in accordance with Class G, Grade 7 (£1,115-£1,245 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 17th March, 1961.

COAL AND ASH HANDLING ENGINEER, NOTTINGHAM POWER STATION (Vacancy No. 30/61).

Applications are invited for the position of COAL AND ASH HANDLING ENGINEER at Nottingham Power Station, Queens Drive, Nottingham.

Applicants must have a wide experience of operation and maintenance at a large power station employing P.F. boiler plant.

Candidates should have suitable technical qualifications admitting to Corporate Membership of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers.

The successful applicant will be responsible to the Station Superintendent for the programming of coal traffic and for the operation of the coal and ash plants.

Salary will be in accordance with Class K, Grade 8 (£1,275-£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th March, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.

7904

ELECTRICAL DRAUGHTSMEN

required for work in Jamaica

SALARIES £1,800 p.a. Living allowances and travelling expenses paid. Minimum qualifications H.N.C. Applicants must have industrial experience and a thorough knowledge of site administration.

Applicants who have had refinery experience, but without the above qualifications, can also apply.

Applications to:—

ELECTRICAL INDUSTRIES LTD.
133, Tower Street
Kingston, Jamaica, W.I. 7749

Unilever

ENGINEER

ASSISTANT ENGINEER

PRODUCTION MANAGER

CEYLONESE NATIONALS ARE REQUIRED TO FILL THESE VACANCIES IN LEVER BROTHERS FACTORY IN COLOMBO

Engineering candidates should have a recognised qualification and a knowledge of Mechanical and Electrical Engineering would be of advantage. Production candidates should possess qualifications in Chemistry or Chemical Engineering. All should be men of about 30 or below who are looking for a progressive management career in their own country.

The seniority in management of the appointments will depend on experience and qualifications; for those with good experience starting salaries are attractive with the addition of a rent assistance scheme, car allowance and four weeks' annual leave.

Successful candidates will receive a few months' experience of Unilever industries in the United Kingdom before proceeding to Ceylon.

Applications, giving full particulars of training and experience should be addressed to: Personnel Division (T/322), Unilever House, Blackfriars, London, E.C.4.

7770

RESIDENT ENGINEER

TELECOMMUNICATIONS DEPARTMENT

MAURITIUS

DUTIES: To organise and supervise the change-over arrangements for the conversion of two main C.B. exchanges to automatic working.

Qualifications: Candidates must be A.M.I.E.E. or Grad.I.E.E. or possess a degree or diploma conferring exemption from the Institutions' examinations, and have relevant experience.

Terms: On contract for 2 years. Salary £1,800 with gratuity. Free passages. Rented Government quarters or an allowance.

Write Director of Recruitment, Colonial Office, London, S.W.1, giving full names, age, qualifications and experience, quoting BCD.133/52/05/D11.

7902

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Assistant Sub-Area Accountant

Frodsham, Near Runcorn

THIS post will become vacant in May, 1961, and applications are invited from qualified accountants.

The position is immediately subordinate to the Sub-Area Accountant who, under the Manager of the Sub-Area, is responsible for the running of the financial and accounting functions in the Board's operating unit covering mid-Cheshire and the towns of St. Helens, Warrington and Widnes in Lancashire.

It calls for experience and success in running a substantial accounts office, an up-to-date outlook on accounting aids to management and some aptitude for methods work.

In this growing industry there are good prospects for advancement for the right man.

Salary within range £1,680/£1,800 per annum (N.J.C. Grade 10).

Good staff conditions. Pension scheme. Appointment subject to medical examination.

Write in the first instance, giving brief but comprehensive personal details, to the Manager, No. 2 Sub-Area, Sandiway House, Northwich, Cheshire. A form for formal application will then be supplied. Closing date, 14th March, 1961. 7923

Situations Vacant (continued)

SOUTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Design and Construction), Devon Group (Exeter).

Salary within Class K, Grade 8, Salary Scale 11 (£1,275-£1,410 per annum) of the N.J.B. Agreement.

The duties of the successful candidate will include the selection of line and cable routes, of substation sites, the design of substations and switching stations, and preparation of estimates; also the preparation of constructional programmes and liaison with other departments of the Board and with outside authorities.

Applicants should possess a wide knowledge and experience of the planning and construction of distribution systems covering overhead lines, underground cables and substations up to 33 kV. Some operational experience is necessary. Qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers are most desirable.

Applications to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the Group Administrative Officer, South Western Electricity Board, 57, Paul St., Exeter. Closing date for receipt of completed applications is 18th March, 1961.

THIRD ASSISTANT ENGINEER (Planning), Chief Engineer's Department, Head Office, Bristol.

Salary according to Class AX, Grade 7, Salary Scale 11 (£1,275 to £1,410 per annum) of the N.J.B. Agreement.

The successful candidate will be responsible for the use of a 50-cycle A.C. network analyser in carrying out investigations into numerous and varied H.V. network problems. From time to time he may be required to assist generally in the Planning or the Technical Section.

Applicants should be in possession of the Higher National Certificate in Electrical Engineering, or equivalent qualification, and some experience in 33-kV and 11-kV planning would be an advantage.

This post would provide an admirable opportunity for a young engineer wanting to specialise in some degree in planning to acquire concentrated experience.

Applications to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the Establishments Officer, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1. Closing date for receipt of completed applications is 18th March, 1961.

THIRD ASSISTANT DISTRICT ENGINEER (Construction), Weston.

Salary according to Class G, Grade 9, Salary Scale 7 (£965 to £1,090 per annum) of the N.J.B. Agreement.

The successful candidate will be responsible to the Second Assistant District Engineer (Construction) for all types of construction work, including H.V. and L.V. overhead lines and underground cables, the preparation of material schedules, the phasing of work, supply of materials, the efficient supervision of works during construction, utilising labour and mechanical aids to the best advantage and regular tool and equipment inspection, keeping a check on costs, preparing reports and statistics, and for the maintenance of progress records. He may be required to carry out standby duty.

Applicants should have had experience in the construction and operation of distribution mains and equipment and should possess a Higher National Certificate in Electrical Engineering or qualifications leading to it. The ability to drive a car and the possession of a current driving licence is desirable.

Applications to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, 168, Locking Road, Weston-super-Mare. Closing date for receipt of completed applications is 18th March, 1961. 7927

STEENSEN, VARMING & MULCAHY
Consulting Engineers

require an ASSISTANT ELECTRICAL ENGINEER-DRAUGHTSMAN in the salary range £600/£1,000 per annum.

Experience in the design of electrical installation in hospitals an advantage.

Apply in writing to :—

STEENSEN, VARMING & MULCAHY
146, New Cavendish Street, London, W.1
7675

CENTRAL ELECTRICITY GENERATING BOARD

Southern Project Group

Programmes Department

APPLICATIONS are invited from suitably qualified engineers for the following appointments in the Programmes Department located at Finchley.

Applicants should be familiar with the problems relating to the overall planning of power station design and construction, be able to compile realistic and detailed programmes of work for all types of contracts and have ability to assess and report on the progress of work at site.

Preference will be shown to members of an appropriate professional institution or those who possess qualifications leading to membership. Applicants should have served a recognised engineering apprenticeship and have experience of generating station equipment, either in the manufacturers' works or on site. A knowledge of the civil engineering work involved would be an advantage.

Salaries will be in accordance with the National Joint Board Agreement Schedule "C," together with a London Allowance of £60 per annum.

SENIOR ASSISTANT ENGINEER
Scale 17 £1,650—£2,085 per annum

SECOND ASSISTANT ENGINEERS
Scale 15 £1,400—£1,830 per annum

THIRD ASSISTANT ENGINEERS
Scale 13 £1,285—£1,610 per annum

Applications stating age, qualifications, experience, present position, salary and post applied for should be forwarded to the Administrative Officer, Central Electricity Generating Board, Southern Project Group, Squires Lane, Finchley, London, N.3, to arrive not later than 10th March, 1961.

Envelopes should be marked "Confidential—ref: S/61/5." 7870

ELECTRICAL ENGINEERS

Why not teach?

There are immediate opportunities for you at—

HACKNEY TECHNICAL COLLEGE

as

I. ASSISTANT LECTURER GRADE B (£738–£1,201) in ELECTRICAL INSTALLATION to teach theoretical and practical sides of City and Guilds Electrical Installation. You should have good experience in the contracting industry or with a supply authority and hold a City and Guilds "C" Certificate or O.N.C. in Electrical Engineering.

II. ASSISTANT LECTURER GRADE A (£558–£1,051) for ENGINEERING WORKSHOPS TECHNOLOGY (elementary workshop technology an advantage). Must have first class trade experience with a good apprenticeship.

Possible additions to salary scale up to £285 for qualifications and training. Point of entry within scale dependent upon experience. Further particulars and application forms from the Secretary (FE.3a/R/542/3), Hackney Technical College, Dalston Lane, London, E.8, to be returned within 14 days. 7871

CITY OF CARDIFF EDUCATION COMMITTEE

Llandaff Technical College

Principal: J. Cotterell, M.I.E.E., A.I.Mech.E., A.M.I.Prod.E.

Department of Electrical Engineering

APPLICATIONS are invited for the post of ASSISTANT LECTURER Grade "B" in the Electrical Engineering Department—duties to commence as soon as possible.

The Department provides Sandwich, Block Release and Part-time Day Courses for O.N.C. City and Guilds Technicians, Installation and Radio. The successful applicant will be required to teach electrical engineering up to S.3 O.N.C. standard. Applicants should possess suitable technical qualifications, e.g. Degree, A.M.I.E.E. or H.N.C. in Electrical Engineering together with industrial experience. Teaching experience would be an advantage.

Salary for this post is in accordance with the Burnham Technical Scale for Assistant Lecturers. Grade "B": £700 × £27 10s. to £1,150.

An addition of up to 12 annual increments may be made to the starting salary for approved industrial or teaching experience, and additional payment may be made for approved training.

Further particulars and application forms can be obtained from the undersigned, to whom they should be returned within 14 days of the appearance of this advertisement.

ROBERT E. PRESSWOOD,
Director of Education,
City Hall,
Cardiff. 7865

ENGINEER REQUIRED

to take charge of Design and Production of

ELECTRICAL INDICATING INSTRUMENTS

principally Moving Iron and Moving Coil

Apply in writing to the Secretary, The Electrical Apparatus Co. Ltd., St. Albans, giving details of age, training, experience and qualifications 7854

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Norfolk Sub-Area

THIRD ASSISTANT ENGINEER (Mobile) (35/61.N).

The successful applicant will be based in the Sub-Area Engineer's Department at Norwich, but will be required to operate anywhere within the Norfolk Sub-Area as required.

Candidates should have had a sound technical training and experience in the planning, construction, operation and maintenance of overhead and underground distribution systems, including substations.

Salary N.J.B. Class K, Grade 9 (£1,190-£1,325).

Apply by letter to the Manager, Eastern Electricity Board, Norfolk Sub-Area, 4, Duke Street, Norfolk, by 17th March, 1961.

Northmet Sub-Area

GENERAL ASSISTANT ENGINEER (CLERK OF WORKS), CIVIL ENGINEERING AND BUILDING SECTION, SUB-AREA ENGINEER'S DEPT. (Ref. 1039) (37/61.R).

Candidates should have had a good general and technical education, possess a sound knowledge of practical building and civil engineering construction, and be capable of setting out and supervising site works.

Salary N.J.B. Class N, Grade 16 (£940-£1,065) inclusive of London allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet House, Southgate, London, N.14, by 17th March, 1961. 7938

DERBYSHIRE EDUCATION COMMITTEE

Chesterfield College of Technology

APPLICATIONS are invited for the full-time post of ASSISTANT GRADE B to teach Electrical Engineering in the Department of Electrical Engineering and Mathematics. Candidates should possess a Higher National Certificate or equivalent qualification and be capable of teaching subjects to Ordinary National Certificate standard. Ability to teach Electrical Installation work will be an advantage.

Salary will be in accordance with the Burnham Technical Scale for Assistants Grade B (£700 × £27 10s. to £1,150) with additions for graduates and allowances for other approved experience.

Further particulars and forms of application from the undersigned to whom applications should be returned by the 15th March, 1961, quoting reference 66d.

S. A. BROADWELL,
Registrar.

College of Technology,
Infirmary Road,
Chesterfield. 7914

DRAUGHTSMAN

SENIOR AND JUNIOR REQUIRED

EXPERIENCE IN CABLE INSTALLATION

DESIGN AND LAYOUT

WRITE STATING AGE, EXPERIENCE AND SALARY REQUIRED

BOX 7707

ENGLISH ELECTRIC
STAFFORD

wish to recruit an

IMPULSE TEST ENGINEER

to assist in the testing of large transformers and other high voltage equipment using some of the largest impulse plant in the world. A certain amount of work will also be required on investigation into discharge and high voltage together with experimental and development work on the generator itself.

The successful applicant is not expected to have relevant impulse experience but must have a good technical background together with an H.N.C. He should have a keen interest in high voltage work and be confident that he can assimilate training quickly.

The post is a permanent and pensionable one and applicants should write, giving full particulars to the Staff Officer, English Electric House, Strand, London, W.C.2, quoting reference ER 1290D.

7888

SOUTH OF SCOTLAND ELECTRICITY BOARD

Glasgow Area

Vacancy

APPLICATIONS are invited for the following superannuable post:—

THIRD ASSISTANT ENGINEER (Meter, Test and Protection).

The duties connected with this post will be the maintenance of electrical standards and instrumentation of a Class A meter testing station; design and testing of complex metering installations; system fault location up to 33 kV; pressure testing of distribution systems, etc., up to 33 kV and testing of power transformers and of insulating oils.

Preference will be given to suitably qualified candidates, and the possession of Graduateship of the Institution of Electrical Engineers or equivalent qualification would be an advantage.

The successful candidate would require to live within reasonable distance of the testing station and be prepared to undertake standby duties.

Salary £1,190-£1,325 per annum in accordance with Class L, Grade 10 (Scale 10) of the N.J.B. Salary Scale.

Applications, quoting reference number GE/14/61, should be made on the standard application form which may be obtained from and should be returned to the Area Secretary, South of Scotland Electricity Board, Glasgow Area, P.O. Box 6, 75, Waterloo Street, Glasgow, C.2, to be received not later than Thursday, 16th March, 1961.

L. HARVEY,
Manager.

7925

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER required for the Technical Section of the Chief Engineer's Department, Board Headquarters, Love Lane, Pall Mall, Liverpool, 3, to operate in the fields of telecommunications, supervisory control and special investigations.

Applicants should have a knowledge of telephone and radio equipment and experience in the planning of communication systems; also experience in the use of instruments and recorders.

Salary within range £1,375/£1,610 per annum (N.J.B. AX.5).

Appointment subject to medical examination. Pension scheme.

Applications, on forms obtainable from the Assistant Establishments Officer at the above address, should be forwarded not later than 17th March, 1961. 7924

CENTRAL ELECTRICITY GENERATING BOARD

Assistant Engineer (Telecommunications)

required at the Central Electricity Research Laboratories, Leatherhead.

The successful applicant will be responsible to the Electrical Installation Engineer for the maintenance of the P.A.X. Systems (300 and 100 lines) and extensions thereto, and the Automatic Staff Location systems and subsequent extensions.

Candidates, preferably holding the City and Guilds Telecommunications Technicians' Certificate or an equivalent qualification, should have first-class experience of this type of work with a manufacturer or the G.P.O.

Salary within the range £800-£1,165 p.a.

Applications stating age, qualifications, experience, present position and salary to the Appointments Officer, 24/30, Holborn, London, E.C.1, by 20th March. Envelopes should be marked "Confidential, Ref. ER/97." 7916

SOUTHERN REGION BRITISH RAILWAYS

require a

Technical Assistant

in the Office of Mechanical and Electrical Engineer (Traction), London Bridge, for work connected with power supply and distribution. Knowledge of remote supervisory control equipment; switchgear and rectifier equipment, and/or high and low-voltage cables and/or overhead lines will be of particular advantage.

Applicants should have had a sound technical training, having reached Higher National Certificate standard in Electrical Engineering or equivalent.

Salary range £945 per annum rising to £1,020 per annum after two years.

Application forms may be obtained from the Chief Mechanical and Electrical Engineer, Southern Region, British Railways, 15, St. Thomas Street, London Bridge, London, S.E.1.

7869

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A and B. Salary includes London allowance.

ASSISTANT OPERATION SUPERINTENDENT, BRUNSWICK WHARF POWER STATION
(Vacancy No. 61/102).

To assist the Operation Superintendent in the efficient running of the generating plant and to be responsible for the statistical returns required by the Generating Board. Applicants should preferably be qualified to H.N.C. standard and have experience in routine testing of boiler and turbine plant. Salary Class K, Grade 6 = £1,500 - £1,670 per annum.

MAINTENANCE ENGINEER (ELECTRICAL), WEST HAM POWER STATION
(Vacancy No. 61/111).

Candidates should have had workshop training with wide general experience of power station electrical equipment and practical experience of E.H.T. switchgear and protective gear. Qualifications entitling to Corporate Membership of the I.E.E. or I.Mech.E. an advantage. Salary Class H, Grade 6 = £1,325 - £1,460 per annum.

Previous applicants need not re-apply.

THIRD ASSISTANT ENGINEER, ELECTRICAL DEPARTMENT, TRANSMISSION SECTION, DIVISIONAL HEADQUARTERS, GENERATION HOUSE
(Vacancy No. 61/112).

Applicants for this vacancy, which occurs in the South Section of the Division, should preferably be Corporate Members of the I.E.E. or hold equivalent qualifications, should have had considerable experience in the operation and maintenance of high-voltage overhead lines and cables, switchgear (oil-filled and air blast) and transformers. They must also have had considerable experience in the operation of the Board's Safety Rules and in the control of both technical and manual staff, and be familiar with the Board's negotiating machinery. Salary Class BX, Grade 8, from 1.7.60 £1,155-£1,460 per annum; from 1.7.61 £1,195 - £1,460 per annum.

Applications, quoting vacancy number, to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box No. 136, London, W.1, by 14th March, 1961. 7908

AIR MINISTRY

(a) STATION ENGINEERS (General Duties).
(b) STATION ENGINEERS (Mechanical).
(c) CLERKS OF WORKS (Building).

PENSIONABLE posts (50 for (a), 10 for (b), 50 for (c)) for men at least 25 and under 40 on 1.1.61 (with extension for regular Forces service and Overseas Civil Service) with appropriate O.N.C. or equivalent technical qualification.

For (a) and (b) comprehensive engineering apprenticeship followed by at least 3 years' experience in an electrical or mechanical engineering firm, preferably on operation and maintenance work, is essential. Supervisory experience and (for (a)) knowledge of heating and ventilating plant and diesel engines an advantage.

For (c) apprenticeship, training in a building school, experience as journeyman in a building trade, or at least 3 years' experience in estimating, costing and management in a builder's general office is essential, followed by further appropriate experience including at least 3 years as foreman or clerk of works.

Ex-R.A.F. Clerks of Works or Station Engineers who do not possess these qualifications may be considered if they have at least 3 years' relevant experience.

Starting salary (national rate) £801 at 25 to £884 at 28 or over. Scale maximum £988. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting S/5269/61. Closing date 6th April, 1961. 7906

ELECTRICAL DRAUGHTSMAN AND ESTIMATOR/DRAUGHTSMAN

required by

J. LYONS & COMPANY LIMITED
(ICE CREAM DIVISION)

A vacancy exists for a SENIOR ELECTRICAL DRAUGHTSMAN required to have experience on General Distribution, Lighting, Motor Controls, Process and Sequence Controls associated with Automation. Some knowledge of Electronics would be an advantage.

A vacancy exists for a SENIOR ELECTRICAL ESTIMATOR/DRAUGHTSMAN required to have experience of Estimating for Electrical Contracting Installations, based on General Distribution Lighting, Motor Controls, Process and Sequence Controls. This will involve a certain amount of preparation of drawings to be used as a basis of estimates. H.N.C. desirable.

An attractive salary will be paid to the right men and the appointment offers good prospects for further advancement. The Company offers good conditions of service and a Contributory Pension Scheme.

Holiday arrangements honoured.

Applications will be treated in the strictest confidence and should be made in writing to :—

The Personnel Manager

Lyons Maid House, Hammersmith Grove, London, W.6 7898

TECHNICAL SALES REPRESENTATIVES

Mawdsley's Limited
Dursley, Glos.

MAKERS of special purpose rotating electrical machinery with wide and varied applications require technically qualified (degree or H.N.C.) SALES REPRESENTATIVES in the North, Midland and South of England areas.

Experience in design or manufacture of the Company's type of product, and related sales experience are essential qualifications.

Salaries will be negotiated. A pension and life assurance scheme is in operation.

Applications will be treated in absolute confidence and should be addressed to the Managing Director giving a full summary of career and training. 7922

MEM

APPLICATIONS are invited for appointment to our sales staff as representative operating within the South Eastern Electricity Board area. The position offers excellent opportunities for the right man; it is pensionable and a motor car is provided.

Please apply in writing to :—

General Sales Manager
MIDLAND ELECTRIC MANUFACTURING CO. LTD.
Reddings Lane, Tyseley, Birmingham, 11
7817

TAYLOR WOODROW CONSTRUCTION LIMITED

require

ASSISTANT ELECTRICAL ENGINEERS

to work in the Electrical Department at Southall.

Candidates must have experience in the design of electrical installations for industrial and general building works and the ability to prepare specifications and estimates.

DESIGN DRAUGHTSMEN

with similar experience to assist in the preparation of contract and working drawings.

Interviews can be arranged at any time including Saturday mornings with expenses paid.

Write to the Personnel Manager
345, Ruislip Road, Southall, Middlesex
7799

WARWICKSHIRE COUNTY COUNCIL

Architect's Department

APPLICATIONS are invited for the following appointments :—

(A) DEPUTY GROUP ENGINEER (HEATING), Grade A (£1,450-£1,565).
Applicants should be members of the I.H.V.E. and have had several years' experience in design, costing and handling large contracts for heating, water supplies and allied services.

(B) DEPUTY GROUP ENGINEER (ELECTRICAL), Grade A (£1,450-£1,565).
Applicants should be members of the I.E.E. and have had several years' experience in design, costing and handling large contracts for lighting, power and allied services.

(C) SENIOR ASSISTANT ENGINEER (HEATING), A.P.T. IV-V (£1,140-£1,480).
Applicants should be Associate Members of the I.H.V.E. with some years' experience and competent to design and specify installations for major building schemes.

(D) ASSISTANT ENGINEER (HEATING), A.P.T. IV (£1,140-£1,310).
Applicants should be recently qualified engineers who are wishing to gain further experience in design of heating and allied services in association with a senior engineer.

(E) ENGINEERING INSPECTORS, A.P.T. III (£960-£1,140).
The successful applicants will be responsible for the inspection and maintenance of the heating, water supplies, electrical installations and allied services in buildings of a district of the county under the Assistant Maintenance Engineer. They should have had several years' experience either in a similar capacity or as foreman in charge of large contracts.

The commencing salary can be within the grades according to ability and experience. Five-day week worked. The Council have schemes for the payment of removal expenses and a lodging allowance to married officers.

Application forms and full conditions applicable to the appointments can be obtained from ERIC DAVIES, F.R.I.B.A., A.M.T.P.I., County Architect, Shire Hall, Warwick.

L. EDGAR STEPHENS,
Clerk of the Council.
Shire Hall, Warwick. 7903

ELECTRICAL ENGINEERS

required for work in Jamaica

SALARIES £2,500 p.a. Living allowances and travelling expenses paid. Qualifications A.M.I.E.E. Applicants must have industrial experience and a thorough knowledge of site administration.

Applicants who have had refinery experience, but without the above qualifications, can also apply.

Applications to:—

ELECTRICAL INDUSTRIES LTD.
133, Tower Street
Kingston, Jamaica, W.I. 7748

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified engineers for the following appointments which are subject to the conditions of the National Joint Board.

Area Board Headquarters

THIRD ASSISTANT ENGINEER,
Chief Commercial Officer's Department,
Mining Section, Newcastle.

Applicants should have a sound technical training and a good knowledge of the use of electricity by all classes of industrial consumers. Duties will include negotiations with consumers.

Salary Schedule B, Class AX, Grade 8, £1,105/£1,325 per annum.

Wear Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER, Durham.

Applicants must have had sound practical training and experience in the construction, operation and maintenance of H.V., M.V. and L.V. overhead and underground distribution networks, substation plant and auxiliary equipment.

Salary Schedule A, Class G, Grade 9, £965/£1,090 per annum.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box 117, Carliol House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement. 7911

ELECTRICAL CONTRACTORS

require

SITE ENGINEERS

1st CLASS EXPERIENCE IN HEAVY INDUSTRIAL INSTALLATION WORK

WRITE STATING AGE, SALARY AND EXPERIENCE

BOX 7708

SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER

APPLICATIONS are invited for the position of ASSISTANT ENGINEER in the East Monmouthshire District (based at Chepstow) in the Monmouthshire and Mid-Wales Area.

Preference will be given to engineers possessing a Higher National Certificate in Electrical Engineering.

Salary N.J.B. Class G, Grade 7, Scale 9 (£1,115-£1,245 per anum).

Applications stating age, present position, present salary, qualifications and experience should be addressed to the Manager, Monmouthshire and Mid-Wales Area, Llywelyn Road, Cwmbran, Mon., to arrive not later than 18th March, 1961.

Please quote reference 24/61/E.R., endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,
Secretary.

7928

WESSEX REGIONAL HOSPITAL BOARD

THERE are vacancies for the following posts in the Architect's Department to deal with the Board's expanding hospital building programme :—

(a) PRINCIPAL ASSISTANT ARCHITECT, GRADE II
(£1,665 × £50 (1) × £75 (2) × £85 (2) to £2,035).

(b) SENIOR ASSISTANT ARCHITECT
(£1,300 × £60 (5) to £1,600).

(c) ASSISTANT ARCHITECTS
(£905 × £35 (1) × £45 (6) × £50 (2) to £1,310).

Applicants must be Registered Architects. The work offers excellent opportunity for gaining experience in the whole field of hospital architecture and covers all stages from sketch plans to the supervision of construction. The proposed expansion of the Board's building programme ranges from major adaptation schemes to comprehensive new hospital projects, and includes all types of medical ancillary departments and domestic buildings.

(d) BUILDING OR QUANTITY SURVEYING ASSISTANT
(£625 × £30 (8) × £35 (1) to £900).

Applicants must have passed the Intermediate Examination of the R.I.C.S. or an examination giving exemption therefrom.

Please apply to the Secretary, Highcroft, Romsey Road, Winchester, for application form, which should be returned by 17th March. 7887

FEDERAL GOVERNMENT OF NIGERIA

ELECTRICAL INSPECTORS

MINISTRY OF MINES AND POWER

ELECTRICAL INSPECTORS required for inspection of electrical supply undertakings and large consumers' installations such as factories, mines and oil wells with a view to enforcement of the appropriate regulations.

Candidates should be Corporate Members of the Institution of Electrical Engineers, or eligible for membership. A university degree in engineering or a diploma issued by a recognised electrical engineering college or school, or both, would be an advantage. Knowledge of flameproof electrical installations is desirable. Experience of inspectorial work would be an advantage.

Salary, according to qualifications and experience, £1,434-£2,196 (including inducement addition) plus gratuity of £150 per annum for satisfactory service. Outfit allowance of £60 is paid on salaries of up to £2,040 (including inducement addition). Appointment will be on contract for one or two tours of 12-18 months (length of tour dependent on candidate's age). Free passages for officer and wife. Children's allowances whilst separated. Home and local leave on full pay. Income tax at low local rate. Rent at low cost.

Candidates should write for application forms and further particulars, stating briefly age, qualifications and experience, to the Recruitment Attaché, Office of the High Commissioner for Nigeria, Nigeria House, 9, Northumberland Avenue, London, W.C.2, quoting Q.1/3.

7891

ALUMINIUM LABORATORIES LIMITED

(The Research and Technical Organisation of the International ALCAN Group of Companies)

AN ELECTRICAL ENGINEER is required to work on experimental insulated aluminium cables. Applicants should have experience in the design, testing and manufacture of insulated power cables and should have suitable academic qualifications. Pension and life assurance scheme in operation.

Please apply to Personnel Officer, Aluminium Laboratories Limited, Banbury, Oxon. 7856

CITY OF LIVERPOOL

Education Committee

College of Technology, Byrom St., Liverpool 3

Principal: S. A. J. Parsons, B.Sc.(Econ.), M.I.Mech.E., M.I.Prod.E., M.B.I.M.

DEPARTMENT OF ELECTRICAL ENGINEERING

APPLICATIONS are invited from suitably qualified persons for the appointment (full-time) of LECTURER in Electronic and Radio Engineering. Duties to commence 1st May, 1961, or as soon as possible thereafter.

Salary £1,370 × £35 to £1,550 per annum (Burnham Technical Report). Commencing salary may be assessed according to previous industrial or professional experience.

Applicants should possess a university degree. Corporate Membership of the Institution of Electrical Engineers would be an added qualification. Industrial and/or research and teaching experience is essential. Person appointed would be encouraged to undertake research and would be expected to organise postgraduate courses.

Application form (returnable by 17th March, 1961) and further particulars from H. S. Magnay, M.A., Director of Education, 14, Sir Thomas Street, Liverpool, 11.

THOMAS ALKER,
Town Clerk and Clerk to the Local Education Authority.

(J.6677) 7868

TAYLOR WOODROW CONSTRUCTION LIMITED

require

ELECTRICAL ENGINEERS

for installation and maintenance work on Civil Engineering and Building contracts.

Experience of tariff and service negotiations with Area Electrical Boards and knowledge of contractor's equipment is desirable.

These posts involve extensive travel and candidates must hold a current driving licence.

Interviews can be arranged at any time including Saturday mornings with expenses paid.

Write to the Personnel Manager
345, Ruislip Road, Southall, Middlesex

7798

ASSISTANT ELECTRICAL ENGINEER

APPLICATIONS are invited from men in the age range 26-32, who are Graduates of the Institution of Electrical Engineers. Experience of modern techniques of electrical installation in large factories, including substations and cable work, is desirable. A knowledge of industrial illumination would be valuable.

This is an interesting and responsible appointment in the head office of a large and expanding company. The appointment will be based in rural Monmouthshire, but will include visits to all the company's factories. For married applicants unfurnished houses would be available to rent, and the company offers assistance in defraying removal expenses.

Please apply in writing, quoting reference E/20, to :—

The Personnel Manager
BRITISH NYLON SPINNERS LIMITED
Pontypool, Mon.

7880

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

Yorkshire Division

Power Station Superintendent, Thorpe Marsh Power Station

APPLICATIONS are invited for the appointment as POWER STATION SUPERINTENDENT at the new Thorpe Marsh Power Station, near Doncaster, designed for an ultimate capacity of 1,100 MW, comprising 2/550-MW units.

The first 550-MW unit will be commissioned in April, 1963, and the second in August, 1964.

Salary £2,815-£3,040 per annum, Class F, Grade 5 of the National Joint Managerial and Higher Executive Grades salary scales.

Candidates should have had wide experience in the management of a large modern power station and possess good engineering qualifications.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 20th March, 1961. 7930

CENTRAL ELECTRICITY GENERATING BOARD

APPLICATIONS are invited for the post of SENIOR ASSISTANT ENGINEER (Technical) in the Operational Efficiency Branch of the Operations Department at Buchanan House, London, E.C.1. The duties will require the application of engineering knowledge and experience to the development and improvement of methods available for monitoring the economic operation of the Board's system and other aspects of performance which contribute to it. This will involve the determination of suitable standards and targets and the periodical review of established methods of assessing performance.

The duties will also include the co-ordination of test results and special ad hoc investigations and will entail collaboration with other sections of the branch and liaison with other branches and departments. Candidates should hold a Degree in Engineering, or an equivalent qualification, and recent experience of power station operation or system operation is desirable.

Salary within scale £1,805-£2,295 per annum.

Applications stating age, qualifications, experience, present position and salary to the Appointments Officer, 24/30, Holborn, London, E.C.1, as soon as possible. Envelopes should be marked "Confidential Ref. ER/84." 7857

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

SHIFT CHARGE ENGINEER is required at Worcester Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade E.7, £965-£1,090 per annum, plus 10% shift allowance.

Applicants should have a sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear. Appropriate qualifications desirable.

Apply, quoting Vacancy No. 36/61.MD, on form A.E.6, available from the Station Superintendent, Worcester Power Station, Hylton Road, Worcester, to whom they should be returned to arrive by 10th March, 1961. 7890

ELECTRIC MOTOR REPAIRS

A MIDLAND Company operating a large electrical and general engineering repair works requires an experienced and determined ENGINEER to control the routine operation of the department. The successful applicant would be directly responsible to the Director in charge of repairs.

Experience in a wide range of electrical repairs is essential and manufacturing experience would be an advantage. In this industry the working hours must essentially be erratic and applicants must realise this.

An attractive salary commensurate with experience, and willingness to undertake responsibility, will be paid. Assistance with housing available.—Box 7840.

AEI

SENIOR DRAUGHTSMAN

LARGE TRANSFORMER DESIGN

Leading Australian Transformer Manufacturer has vacancy for experienced Transformer Designer Draughtsman. Age 30-50 years. Essential qualifications: sound mechanical training in transformers 10 MVA to 100 MVA range. Starting salary £A1,500. Reply to:

Secretary
ASSOCIATED ELECTRICAL INDUSTRIES (OVERSEAS) LIMITED
33 Grosvenor Place, S.W.1

7879

THE ELECTRIC CONSTRUCTION COMPANY LTD.

Bushbury Engineering Works, Wolverhampton

Good vacancies for

SALES ESTIMATING ENGINEERS

to prepare tenders and specifications and to handle complete contracts for rotating electrical plant and/or automatic control gear.

Applicants should preferably have experience as estimating or contracts engineers, but consideration will be given to young electrical engineers without commercial experience.

Excellent opportunities. Profit sharing and pension schemes in operation.

Applications to the **Contracts Manager** at the above address.

7867

YORKSHIRE ELECTRICITY BOARD

No. 1 (Bradford) Sub-Area

KEIGHLEY DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER.

Applicants should have passed the Associate Membership Examination of the Institution of Electrical Engineers, or hold equivalent qualifications, and have experience in construction, operation and maintenance of high voltage systems, underground cables and overhead lines and substations, and medium low voltage networks.

Candidates should be prepared to reside within the District and undertake standby duties.

Salary N.J.B. Class F, Grade 9 (Scale 6), £890/£1,015 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45/53, Sunbridge Road, Bradford, 1, not later than 17th March, 1961. 7912

SALES ENGINEER

Scotland

AN English company, with a long tradition in the design and manufacture of electrical plant for the industrial and marine markets, wishes to appoint a SALES ENGINEER as sole representative for Scotland.

Applicants should be Degree/H.N.C. standard, works trained in rotating machines, experienced in project engineering, and must have a successful sales record in the electrical industry, at least partially in Scotland. A good salary will be paid for the right man.

No reference will be made to present or past employers without an applicant's express permission. Applications should therefore include full details, and should be sent to the Personnel Manager.—Box 7921.

NORTH WESTERN ELECTRICITY BOARD

First Assistant District Engineer, Leigh District

The successful applicant will be required to assist the District Engineer in the construction, operation and maintenance of the 33-kV, 11-kV and 6.6-kV systems, and the planning of the 11/6.6-kV and L.V. networks.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,650/£1,830 p.a., Grade J.3. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 2 Sub-Area, North Western Electricity Board, 2, St. George's Road, Bolton, and returned to him by 13th March, 1961.

Foreman, Oldham District

The successful candidate will be required to supervise cable laying and jointing and the erection and maintenance of overhead lines up to and including 33 kV.

Salary £795 p.a., Grade 2, Schedule E. N.J.I.C. conditions.

Applications to Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, by 18th March, 1961. 7918

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

South Caledonia Area, Blackfriars, Perth

APPLICATIONS are invited for the following posts:—

FIRST ASSISTANT DISTRICT ENGINEER, DUNBLANE,
Graded E.4 (£1,190/£1,325).

Applicants must be technically qualified and preferably Corporate Members of the I.E.E. Planning, construction and operational experience essential. A car allowance will be payable.

FOURTH ASSISTANT ENGINEER, AREA HEADQUARTERS, PERTH.
Graded G.14/13 (£670/£750/£805).

To assist the Contracts Engineer in the preparation of estimates and tenders for engineering construction.

Applications, on special forms, must be submitted within fourteen days of this advertisement. 7909

MINISTRY OF AVIATION

require ELECTRICAL ENGINEERS as Assistant Signals Officers. Posts mainly in London, but some in Provinces.

Duties include planning, evaluation, installation and supervision of operation and maintenance of civil aviation telecommunications and navigational aids at airports and telecommunication centres.

Quals.: 1st or 2nd Class Hons. Degree in Physics or Engineering, A.M.I.E.E. or A.F.R.Ae.S. Candidates with Parts I, II and III of A.M.I.E.E. or Parts I and II of A.F.R.Ae.S. or equiv., or of high professional attainment without these quals. considered.

Salary scale £690 (at age 23) to £1,300. Slightly lower for posts outside London. Promotion prospects.

Further details and forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.161/OA. 7872

BRITISH OVERSEAS AIRWAYS CORPORATION

Properties Maintenance Engineer, Karachi

APPLICATIONS are invited from men aged 25 years and over with a good standard of general education for the post of PROPERTIES MAINTENANCE ENGINEER, Karachi.

Initial engagement will be at London Airport and subsequent employment in Karachi. Salary, U.K. range £1,005 to £1,190, on posting to Karachi Rps.1,740 to Rps.2,075 plus free furnished accommodation, marriage and children's allowance, tax free.

Essential qualifications: Experience with diesel generators, and operation of power house, heating, air-conditioning and cold storage systems. Maintenance of electrical, power and lighting installations. Also control of contractors and ability to read drawings and understand specifications.

Applications to be forwarded to Personnel Manager, Eastern Routes, M.326, H.Q. Building, B.O.A.C., London Airport, Hounslow, Middlesex. 7905

NORTH WESTERN ELECTRICITY BOARD

Senior Sales Representative (Development), Wigan District

APPLICANTS should be thoroughly conversant with supply matters, tariffs, apparatus and sales to domestic, commercial and small industrial consumers; have a good sales record and the capacity to progress in a live organisation.

The possession of the E.D.A. Salesmanship Certificate would be an advantage.

Salary scale £700/£775 p.a., Grade 2. N.J.C. conditions.

Applications on forms to be obtained from the Manager, No. 2 Sub-Area, North Western Electricity Board, 2, St. George's Road, Bolton, and returned to him by 13th March, 1961. 7886

THE LYON GROUP

require

A MANAGER to take charge of their Electrical Department. The successful applicant must have wide technical experience and a detailed knowledge of costing and estimating. He must be used to controlling staff on widely dispersed sites.

The post offers excellent scope for advancement for a man with the necessary determination, vision and energy to produce real results and profit. A good basic salary will be paid plus generous bonus or profit sharing. A car will be provided and a non-contributory pension scheme operates.

Apply in writing to A. G. Byfield, Director, Ronald Lyon Construction Ltd., Auckland House, New Zealand Avenue, Walton-on-Thames. 7863

NORRIS CONSULTANTS LIMITED

require for the

Electrical Engineering Department at Bristol Head Office

the following staff :—

2 ELECTRICAL ENGINEERS (Corporate Members).

2 ASSISTANT ELECTRICAL ENGINEERS.

4 ELECTRICAL ENGINEERING DRAUGHTSMEN.

Applications are invited from engineers and draughtsmen with experience in building installations, power station work, distribution and control equipment.

Send full details, quoting reference M.R.N., to Beacon House, Queen's Road, Clifton, Bristol, 8. 7853

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Assistant Shift Charge Engineer

Carolina Port Power Station

A VACANCY, as above, will shortly occur at the 75 MW Dundee Power Station. Applicants should be of H.N.C. or equivalent standard and preferably with experience of power station operation.

The post is superannuable, the salary being in accordance with Class F/9, Scale 6 of the N.J.B. Agreement, being at present £890-£1,015 plus 10% shift enhancement.

Application should be made on the standard form obtainable from the Area Manager, North of Scotland Hydro-Electric Board, Dudhope Crescent Road, Dundee, and be submitted by 22nd March, 1961. 7920

ELECTRICAL ENGINEER

required

for large, expanding contracting organisation. Applicants should have wide experience in the design and preparation of estimates for all classes of industrial and commercial projects.

The position is superannuated and offers a good salary to the right man.

Applications, which will be treated in strict confidence, stating salary required, etc., should be addressed to :—

Managing Director

SCULL ELECTRICAL LIMITED

Redcliffe House, Bedminster, Bristol, 3 7899

CITY OF LIVERPOOL

City Lighting and Electrical Department

APPLICATIONS are invited for the appointment of DEPUTY SENIOR ASSISTANT (Technical). Salary £960 to £1,140 per annum (A.P.T. III).

Duties involve assisting in planning of large-scale electric installations, street lighting and testing of lighting and electrical equipment. Applicants must possess Higher National Certificate in Electrical Engineering and/or City and Guilds Final Certificate in Illumination (or equivalent). Previous experience of lighting installations in public buildings, etc., is desirable.

Applications, giving full details, including qualifications and experience, to be received by the City Electrical Engineer, 19, Highfield Street, Liverpool, 3, by 8th March, 1961.

THOMAS ALKER,
Town Clerk.

(J.6669) 7901

SOUTHERN ELECTRICITY BOARD

General Assistant Engineer

MELKSHAM District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class G, Grade 14 (£670-£750 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with distribution including minor construction work and general maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant, etc. Applicants should possess suitable technical qualifications.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks., and returned to him, quoting Z.1326, not later than 13th March, 1961. 7915

LONDON ELECTRICITY BOARD

Assistant Distribution Engineer

APPLICATIONS are invited for the above position in the Board's Essex Suburban District at 497/9, Ley Street, Ilford.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 12, £875 per annum rising to £990 per annum, inclusive of London allowance.

Applications stating age, qualifications and experience should be sent direct to the Manager, Essex Suburban District, 497/9, Ley Street, Ilford, within fourteen days of the publication date of this notice. Please quote reference PER/V/3205/R. 7926

ELECTRICAL PROJECT AND DEVELOPMENT ENGINEER

WE are looking for a young qualified electrical engineer, degree or equivalent, to assist our Development Engineer with work on problems connected with the design and control of rotating electrical machines. The appointment is suitable for a graduate who has some experience of rotating machines and of conducting experimental work and is interested in electrical research particularly in the field of control schemes.

Suitably qualified men, who may or may not entirely fit the above specification, but who feel they would nevertheless suit our purpose are invited to apply, giving full details of education, training and experience to the Managing Director, Mawdsley's Limited, Dursley. Applications will be treated as strictly confidential. 7696

FOSTER TRANSFORMERS LTD.

South Wimbledon, London, S.W.19

require TEST ENGINEER with good electrical background not necessarily on power transformers.

Apply to the Personnel Officer stating age and previous experience. 7864

UNITED KINGDOM TECHNICAL ASSISTANCE

EXPERT IN ELECTRICITY SUPPLY ECONOMICS AND TARIFFS STRUCTURES is required for SIX MONTHS in DACCA, EAST PAKISTAN, to advise the Government on formulating revised tariffs. Candidates should be not less than 35 years and have wide experience in formulation of supply tariffs, methods of metering, revenue collection and billing.

SALARY £3,000-£4,000 p.a. (subject to U.K. income tax) according to qualifications and experience, plus tax free allowances £1,690 per annum (married) and £960 per annum (single). Free furnished accommodation is provided or allowance in lieu. All emoluments paid by U.K. Government.

Apply to Ministry of Labour (E.9), 26, King Street, London, S.W.1, quoting PAK/43. 7907

SURREY COUNTY COUNCIL

APPLICATIONS invited for appointment of ASSISTANT ELECTRICAL ENGINEERS on Grade IV (£1,140 - £1,310 p.a., plus £45 p.a. London allowance). Must be A.M.I.E.E. and have had experience in design of large electrical services installations. The successful applicant must be capable of taking charge of works from commencement to final completion.

Approved removal expenses will be paid to successful candidates in this grade.

Candidates will be appointed at the appropriate point within the scale according to age and ability.

Full details, present salary and three copy testimonials, preferably one from present employer, to County Architect, County Hall, Kingston, as soon as possible. 7816

ACCOUNTS clerk, senior, required by large London electrical company. Excellent opportunity. Write experience, age, salary.—Box 7701.

ARMATURE winder competent to take charge small motor rewind dept. of old-established North-Eastern contractors. Good wage and pension scheme. Apply stating age, experience and technical education, etc., to—Box 7876.

B.K.B. ELECTRIC MOTORS Limited, Birmingham, 18, manufacturers of A.C. and D.C. motors, generators and equipment, require a sales engineer for London and the South-East Counties. Applicants please apply in writing giving age, experience, salary to—The General Manager, B.K.B. Electric Motors Ltd., 132, Icknield St., Birmingham, 18. 5037

CABLE contracts engineers required with experience installations to at least 33 kV. Must be prepared travel anywhere in U.K. Apply giving details of work carried out to—Contracts Manager, Enfield-Standard Power Cables Ltd., Stockingswater Lane, Brimsdown, Middlesex (Tel. No. Howard 2711). 7885

CHIEF estimator required. Applicants must have experience with metal work and electrical fitting manufacture. Excellent conditions and prospects. Age limit 50. Replies in strictest confidence to—Box 7874.

CONSULTING engineer requires junior electrical draughtsman for assistance on internal installation planning in new buildings. Luncheon vouchers. Applicants should state age, experience and salary required.—G. H. Buckle & Partners, 2, Harrington Gardens, London, S.W.7. 7932

COST and accounts clerk required by West End (London) electrical contractors. Age 25-30. Write stating age, experience and salary required.—Box 5031.

DRAUGHTSMAN req. by elec. engrs. and contractors in London S.W.1 area, with experience of preparing drawings for electrical installation schemes. Write age, exp. and salary req. to—Box 7935.

ELECTRICAL design engineer for consultant's office, experienced all aspects general contracting. Age 25-35.—Laurence Oliver, 57, Victoria St., London, S.W.1 (SUL. 2041-3). 7896

ELECTRICAL development engineer required for a company situated in N.W. London, for work on design and development of special-purpose equipment, machine tool control systems and small electrical machines and appliances. Minimum qualification H.N.C. or equivalent. Practical experience in this field an advantage. Salary £1,100.—Box 7937.

Situations Vacant (continued)

ELECTRICAL estimator required for Mid-Tyne shipyard. Applicants must be conversant with modern marine A.C. and D.C. electrical ship installations; capable of taking charge of an estimating section and working with the minimum of supervision. Apply to—Box 7875.

ELECTRICAL installation inspector/tester required by consulting engineers to visit oil installations in Midlands and North of England. Experience of flameproof installations essential. Write to—A. J. Ramsay & Partners, 5/6 Promenade Chambers, Edgware, Middlesex. 7860

ELECTRICAL insulation division of large London paint company requires chemist for development and technical service work. Applicants should have good general background in varnish and resin technology and be familiar with the insulating and impregnating requirements of the electrical industry. The division is expanding and there is considerable scope for a man with initiative and ability. Apply in strict confidence to Chief Chemist.—Box 7882.

ELECTRICAL site foremen, chargehands and electricians wanted for large contracts in London, Midlands and Wales. Conduit and M.I.C.C. installations. Write—Box 7931.

ELECTRICAL wholesalers invite applications from stores and clerical personnel with some knowledge of the trade, seeking a progressive position. — L.E.C., 92, Blackfriars Road, London, S.E.1. 7783

ENGINEER (estimating), senior, thoroughly experienced electrical cable installation work, required for progressive situation large London firm engineers. Write confidentially age, experience, salary.—Box 7848.

ESTIMATING/supervising electrical engineer required for contractor's London office. Applications stating experience, salary, etc., to—Phœnix Electrical, Phœnix House, 16-18, Marshalsea Road, London, S.E.1. 7883

FOREMAN. Large company dealing with electrical transmission and distribution require the services of an experienced foreman for work on cable laying contracts. Please send details of previous experience to—Box 5038.

JUNIOR designer required by electrical component manufacturers in N.W. London. Good knowledge of radio frequency circuits and experience in electronics, radio and/or television industry would be an advantage. Write giving full details of experience, age and salary required to—Box JD.4895, A. K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. 7772

JUNIOR sales engineer required by Birmingham manufacturers of electrical rotating plant. The duties will include the handling of correspondence with customers, submission of quotations and customer liaison. Applicants must be of Graduate I.E.E. standard and preferably with experience in commercial and technical correspondence. This is a position with prospects of advancement. The successful applicant will have the opportunity of promotion to a more responsible position with wider interests. Write giving concise details and stating salary required to—Box 7936.

LABORATORY technician required for electrical engineering and physics laboratories, L.C.C. South-East London Technical College, Lewisham Way, London, S.E.4. Facilities for further education. £420 at 21 to £580. Holders of recognised qualifications £500 at 21 to £660. 39-hour week. Forms, returnable within 14 days, from Secretary. Please quote (Estab. 7/E/521/3). 7877

LABOUR and plant supervisor required for contracting section of large electrical company. Applicants should be thoroughly experienced in cable installation, jointing procedure and handling of labour, together with the purchasing and maintenance of suitable plant. An intimate knowledge of the rates of pay and conditions of working applicable to the appropriate trades essential. Permanent superannuated post. Write stating age and details of previous experience to—Box 7858.

OVERHEAD line engineer required by consulting engineers in their head office. Experience required in design and contract work of tower and wood pole lines. Applications stating age, qualifications, experience and salary required to—Kennedy & Donkin, 12, Caxton St., London, S.W.1, quoting ref. JGW/HSJ. 7884

SENIOR technical draughtsman. Able to prepare working details for lighting fittings. Some experience in this field essential. Apply—Troughton & Young (Lighting) Ltd., 143, Knightsbridge, London, S.W.1. 7873

POLYPHASE test. Experienced testers or improvers. These vacancies afford unique opportunity for experience on calibration of a wide range of integrating electricity meters and ancillary equipment. Staff status after qualifying period. Please enquire—Personnel Manager, Landis & Gyr Ltd., Victoria Road, North Acton, London, W.3 (ACOrn 2282). 7829

RELAY designer required by established electrical company to design complete range of protective and auxiliary relays. Applicants must be fully experienced in modern techniques of relay design and manufacture. Salary will be commensurate with experience and qualifications. Applications, giving full personal and professional details, to—Box 7797.

REPRESENTATIVE required by established Essex and North London wholesalers. Experienced man with contacts in contracting, retail and industrial fields preferred but not essential. Salary, commission and car allowance, also superannuation scheme. Write details, etc., to—Box 7933.

REQUIRED by electrical engineering company, Great West Road, young man aged between 18 and 24, with some previous experience of preparing quotations, general correspondence and sales routine, or alternatively undergoing technical training with a view to indoor sales career. Successful applicant must have drive and ultimately be able to work on own initiative. Canteen facilities, pension and bonus schemes in operation. Reply in confidence stating experience and expected salary to—Box 7859.

REQUIRED by London electrical contractor, a competent engineer to manage their Birmingham branch office. Experience must include telephone installations of all types. Please reply stating age, experience and salary required to—Box 7782.

ROUND OAK STEEL WORKS Limited require an electrical engineer as assistant to the chief electrical engineer. The appointment carries responsibility for technical development and improvement under the general guidance of the Chief Electrical Engineer. Candidates, preferably with experience in the heavy electrical field, should possess H.N.C. minimum, or graduate standard qualifications. Write giving age, details of experience, qualifications and salary level expected to the Manager, Personnel Dept., Round Oak Steel Works Ltd., Brierley Hill, Staffs. 7895

SENIOR and junior electrical design engineers/draughtsmen required for consulting engineers' office. 5-day week, luncheon vouchers, Spring and Summer holidays. Applicants for senior positions must be experienced in design of electrical services for modern hospitals, universities, factories, etc. Please apply stating age, experience and salary required to—J. Stinton Jones & Partners, 21, Gloucester Place, London, W.1. 142

SENIOR electrical foreman required by manufacturer of engine-driven generating sets and control panels. This is a progressive appointment for a man capable of organising efficient production in all aspects. Applications stating age, experience, present salary and salary required to—General Works Manager, A. C. Morrison (Engineers) Limited, Town Quay, Southampton. 7686

SUPERVISING engineer required by large London electrical contractors. Very good prospects; superannuation scheme after probationary period. Only engineers with similar previous experience of controlling contracts from estimating stage to final completion need apply. Reply to—Box 7695.

TECHNICAL representative required, resident in Coventry, Birmingham or Wolverhampton district, for sale of switchgear, instruments, power factor correction capacitors, trunking and crane collector gear. Apply—A. J. Mare (B'ham) Ltd. Holly House, Shady Lane, Great Barr, Birmingham, 22a. 7934

TEST engineer required for responsible position in test department. Sound electrical knowledge essential. Experience of transformers and rectifying equipment an advantage. Apply in writing—F. C. Heayberd & Co. Ltd., 114, Greenwich South Street, London, S.E.10. 5039

TRANSFORMER designer. To lead and control design and drawing office. A person of wide experience coupled with ability and enthusiasm is required. The position carries commensurate salary and promising future. Apply in writing—Willesden Transformer Company Ltd., Manor Park Road, Harlesden, London, N.W.10. 309

SURVEYOR required for wood pole line work. Permanency right man. Kirriemuir area.—B. French Ltd., Pike Mills, Kidderminster. 7897

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

ADMINISTRATION manager, electrical engineering contractors, desires change. Similar position with progressive concern in London or South East England preferred. Experienced contract accounts and statistics, office, personnel, transport and premises management. Please write—Box 5020.

A.M.I.E.E. (46), seeks executive/responsible/organising post in medium or small firm. Recent appointment, otherwise successful, lacks each feature wasting natural abilities. Trained and practised technical sales manager. Formerly designer; also site supervision. Wide experience light/medium engineering except for electronics. Successful with staff and customers whatever status. Prompt, clear correspondent. Hawk's eye for essentials, details or errors. Pride in work. London based but used to spur of moment travel.—Box 5036.

AN electrical engineer, age 45, just returned to United Kingdom, seeks position as technical sales engineer. Home or overseas. Good knowledge export procedure.—Box 5026.

ENGINEER (B.Sc. 1st Hons., A.M.I.E.E.). Age 35; wide experience in design, development, application and service of battery electric vehicles and all associated equipment. —Box 5021.

EX-merchant navy first electrician, 29, seeks suitable, varied and progressive position as maintenance electrician anywhere except London area. Qualifications, O.N.C. Elect., City and Guilds; installation work; clean driving licence.—Box 5041.

REPRESENTATIVE desires change, all types f.h.p. motors, geared, specials, etc.; also rotary equipment. Calling on all branches of industry in entire London postal districts and counties. Management considered.—Box 5032.

SCOTLAND. Sales engineer with live first-class connections with the industrial users, nationalised industries, shipyards and electrical trade seeks position as manager or representative. Free 1st of March. Min. salary £1,250.—Box 5043.

WHOLESALER'S E.W.F. branch manager seeks change with greater responsibility, prospects, perhaps working with smaller but growing concern, in responsible position with good prospects. London area.—Box 5027.

ARTICLES FOR SALE

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd. London W4. 57

A.C. and D.C. slotmeters and quarterlies. Reconditioned, guaranteed 2 years. Repairs and recalibrations.—Victor Electric Co., South View, Sweet Hill, Patcham, Brighton, Sussex. London agents, phone Downland 4682 (Surrey). 5001

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

ALTERNATORS for sale from 1,100 kVA at 750r.p.m. down to ½ kVA. Single and three-phase. All voltages. More than 150 machines in stock. Automatic regulators and switchboards available.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists. — Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT-breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

COMPLETE 500-yd. drums of .0225/.2 4-core PILC SWA unused underground cables at competitive prices.—Brentford Electrical Wholesale Co., Kew Bridge (ISLeworth 4466). 7699

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors and generating equipment.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 116

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

FLUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Olive Street, Bury (Telephone, Bolton 27251). 212

FOR sale, good unused and used machinery including electric motors, A.C. and D.C. dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

FRACTIONAL h.p. motors down to 1 R.P. week; 250 Hoover motors always in stock; 11 different ratios of David Brown gear boxes always available means a motorised unit from stock. From—Jearys, 132, East Road, London, N.1. 126

GENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C. — Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (5444/7). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY credit meters, single and poly-phase, 2½-100 amps. From 20/-. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E.C.1. 34

SMALL BR screws and nuts in steel, brass and stainless steel, from stock. — Premier Screw & Repetition Co. Ltd., Woodgate, Leicester. 180

TELEVISION slotmeters and time switches. Details from: Tradex Meter Co., Surbiton (Elmbridge 2234/5/6). 172

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

500-kW, 220-volt Met.-Vick. rotary converter, with transformer, 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

900-kW/1,125-kVA and 2,500-kW/3,125-kVA condensing turbo-alternators, 200 lb. steam, 440 volts. Both Metrovick self-contained type.—Box 5035.

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire, 24-hr. breakdown service. — Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

ARTICLES WANTED

WANTED

D.C./A.C. Motors, Transformers, Cables and all redundant Power Station plant wanted for dismantling.

ASK US TO QUOTE

B. M. T. CO. LTD.
London Road, Barking
(RIP. 3387/3715)

298

A.C./D.C. electric motors, generators, transformers, disused stocks of cable, power houses bought and dismantled.—Samuel Hyams, 129, Lambs Lane, Rainham, Essex (Rainham 4896). 125

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London E.1. 120

WANTED, rotary converters, any sizes.—Universal, 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

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535 VEHICLES AND MOTOR CYCLES

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FOR VIEWING DATES AND TIMES SEE PAGE VIII IN THE CATALOGUE.

CATALOGUES, price 1s. each (P.O. only), to admit TWO PERSONS to View and ONE PERSON to the Sale, may be obtained from the Auctioneers' Offices, Dept. 3, Byard Lane, Bridlesmith Gate, Nottingham, from 27th February onwards.

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7861

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

AVAILABLE capacity for winding fractional to 200-h.p. motors. Also machining and assembly of electrical components. Leading manufacturers please note. Skilled operatives, small overheads enable keen prices, by contract or otherwise. Rewinds and repairs.—S. W. Fletcher (Electric Motors) Ltd., 33, Elenora Street, Stoke-on-Trent (Tel. 44551). 48

ENGRAVED nameplates and labels in all materials. — A. T. Brown & Co. Ltd., 347-349, Katherine Road, Forest Gate, London, E.7 (Tel. Grangewood 1024). 198

Work Wanted and Offered (continued)

CAPACITY available. Use our Toroidal Winding Machines. Capacity available for winding cores, having finished i/d of .055" up to 24" o/d with 6" maximum height. Experienced engineers, skilled operators are available to give efficient service and speedy delivery. Enquiries—Production Engineer, Toroid Division, Aveley Electric Limited, South Ockendon, Essex (SOO 3444). 7461

FLUORESCENT fittings, shells and chokes to BS 2818 (Licence No. 3237), coil winding, all sheet metal work.—D. E. Cowling & Sons Ltd., Romside Trading Estate, North St., Romford 47282. 60

PRODUCTION winding of armatures, stator, coils, transformers. Also special motors. Prompt and reliable deliveries.—Lewis Electric Motors Ltd., Moor Wks., Maidenhead, Berks. 194

BUSINESSES FOR SALE AND WANTED

BIRMINGHAM. For sale, share capital of old-established company manufacturing good class lighting fittings, glassware, etc. Valuable connection throughout England and Wales. Freehold premises within 2 miles city centre, particularly suitable for firm wishing to establish Midlands depot. Purchase price about £20,000.—Box 7718.

EAST Anglian Coastal Town. For sale, electrical contracting-retail business. Turnover £10,000 per annum. L/u. premises; shop-office-workshop; shopping area. Premises, business, stock, £4,500.—Box 5040.

BUSINESS OPPORTUNITIES

ELECTRICAL wholesalers, small/medium sized. Some radio. Excellent leased premises, North London.—Box 7719.

FOR sale, old-established electrical and mechanical engineering company in Swansea area. Small tax losses. Suitable for expansion. Proprietor proposes age retirement. Inquiries invited.—Box 7878.

RANGE of highly efficient patented limit switches, with large sales potential, offered to substantial manufacturer on royalty basis, or outright sale.—Box 5028.

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REARRANGEMENT of ground makes agencies available for Domestic Electric Appliances Division of large manufacturers in the following areas:—

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Yorkshire (East and West Ridings).

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Hampshire and outer Surrey.

State other lines covered.

METWAY ELECTRICAL INDUSTRIES LTD.

Metway Works, Brighton, 7

4'

AGENT required, preferably in Gloucester for Bristol area to handle small rotating electrical machinery. Agency for Cornwall, Devon, Somerset, Wiltshire, Gloucestershire and South Wales. State agencies now held when replying. Please write—Sales Director, Small Electric Motors Ltd., Beckenham, Kent. 7881

BRITISH agents having large ramifications within the electrical field seek additional agencies from Continental manufacturers of electrical accessories, small domestic electric appliances, etc. Substantial references and ample finance available.—Box 119.

MANUFACTURER of small type transformers wishes to appoint an agent with connections in the electrical industry.—Box 5042.

EDUCATIONAL

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

BURSARIES available for postgraduate courses in Aeronautics, Chemical, Civil, Electrical and Mechanical Engineering for session 1961-62. Value £500-£700. Applicants should be United Kingdom residents who must have spent at least one year away from university since graduation, preferably in industry.

Further information from Registrar, Imperial College, London, S.W.7. Closing date 18th May, 1961. 7862

CITY and Guilds (Electrical, etc.) on "No pass—No fee" terms. Over 95% successes. For details of modern courses in all branches of electrical engineering, applied electronics, automation, etc., send for our 148-page handbook—free and post free.—B.I.E.T. (Dept. 12a), 29, Wright's Lane, London, W.8. 100

BOOKS, INSTRUCTIONS, ETC.

FOUNDATIONS of Wireless. Seventh edition. M. G. Scroggie, B.Sc., M.I.E.E. Retains that easy style which has commended it to the countless thousands who have gained their first acquaintance with radio from this book since it was first published 24 years ago. It covers the whole basic theory and, starting from the most elementary principles, and assuming no previous knowledge on the reader's part, deals with receivers, transmitters, amplification, valves, transistors, aerials, power supplies and transmission lines. Although the backbone of the book is still sound broadcasting, there is more emphasis throughout on f.m., v.h.f. and television, and the television, and the treatment of frequency changers has been rewritten from the standpoint of modern practice. Earth-grid and cascade v.h.f. amplifiers, colour television, e.n.t. generators and transistor voltage raisers are included, and transistors have been treated in greater detail than hitherto. 15s. net, from all leading booksellers. By post 17s. 4d. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1. C1

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COMPANY MEETINGS

GOBLIN (B.V.C.) LIMITED

(Originators of the Vacuum Cleaner)

Plea for Firm Government Policy

THE 57th Ordinary General Meeting of Goblin (B.V.C.) Limited was held on 23rd February at Leatherhead.

Mr. O. D. Angell, Chairman, presided and, in the course of his speech, said:—

It was my pleasure a year ago to report a net profit of over one quarter of a million pounds, and I told you that we were in a good position to take our share of the improved trading brought about by freedom from hire purchase and credit controls. The results were such that we decided to recommend the highest payment of dividend ever made by your Company.

At that time the outlook held great promise for a new record year of trading, which promise was to be rudely disturbed by the harsh and sudden resumption of the controls above referred to. The home market for certain of our domestic appliances contracted over-night and our battle to maintain profitable production began.

While it may be necessary for the Government from time to time to take steps to control inflation and balance of payments, it certainly creates problems in our Domestic Industry. The sudden changes of Government policy cancel out the best of planning. Our plea to those in authority is to give us continuity of policy and allow us to develop the essential home trade which establishes the very necessary starting point for a strong export trade. We say to the Government, "decide upon your policy, announce it, and then allow us to plan and develop in accordance with your terms."

Of this we are sure, our Goblin products are good value and our domestic turnover will not compare unfavourably with the figures of the trade. The Goblin "Teasmade" is a record seller and the range of Goblin Cleaners is well received. The sales of other Goblin products are also showing promise. Our experience in the export market has been encouraging, but only to the degree in which we have been able to keep our prices competitive in spite of the unsettled home markets.

Diversification

During my few years as Chairman, I have told you of the efforts of your Board to render the fortunes of the Company less vulnerable to extreme fluctuation, and I now propose to discuss some of these aspects of development within our Group.

The Specialised Electric Motor manufacturing has proceeded as planned and is continuing to be a worthwhile development.

Our Industrial Vacuum Cleaner division is ever expanding and results to date give us every confidence in our growing future in this sphere.

Our Magneta subsidiary has received much attention and here again we believe we are capable of substantially expanding our activities. This division markets Time Recorders, Clock systems and Public Address equipment.

Our export situation in this sphere of activity has shown very substantial growth and we are confident will continue so to do.

Our subsidiaries abroad are trading well with the exception of Canada. We have a substantial stake in the Canadian market and we are aware that we must meet the existing conditions by a completely new sales outlook. This year we have already taken important steps towards meeting this situation.

Throughout our organisation we are conscious of the necessity to diversify, and developments to this end give good grounds for encouragement.

The Report and Accounts were adopted and the proposed Ordinary dividend of 10%, less tax, was approved. 7893

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